SCIENTIFIC AMERICAN

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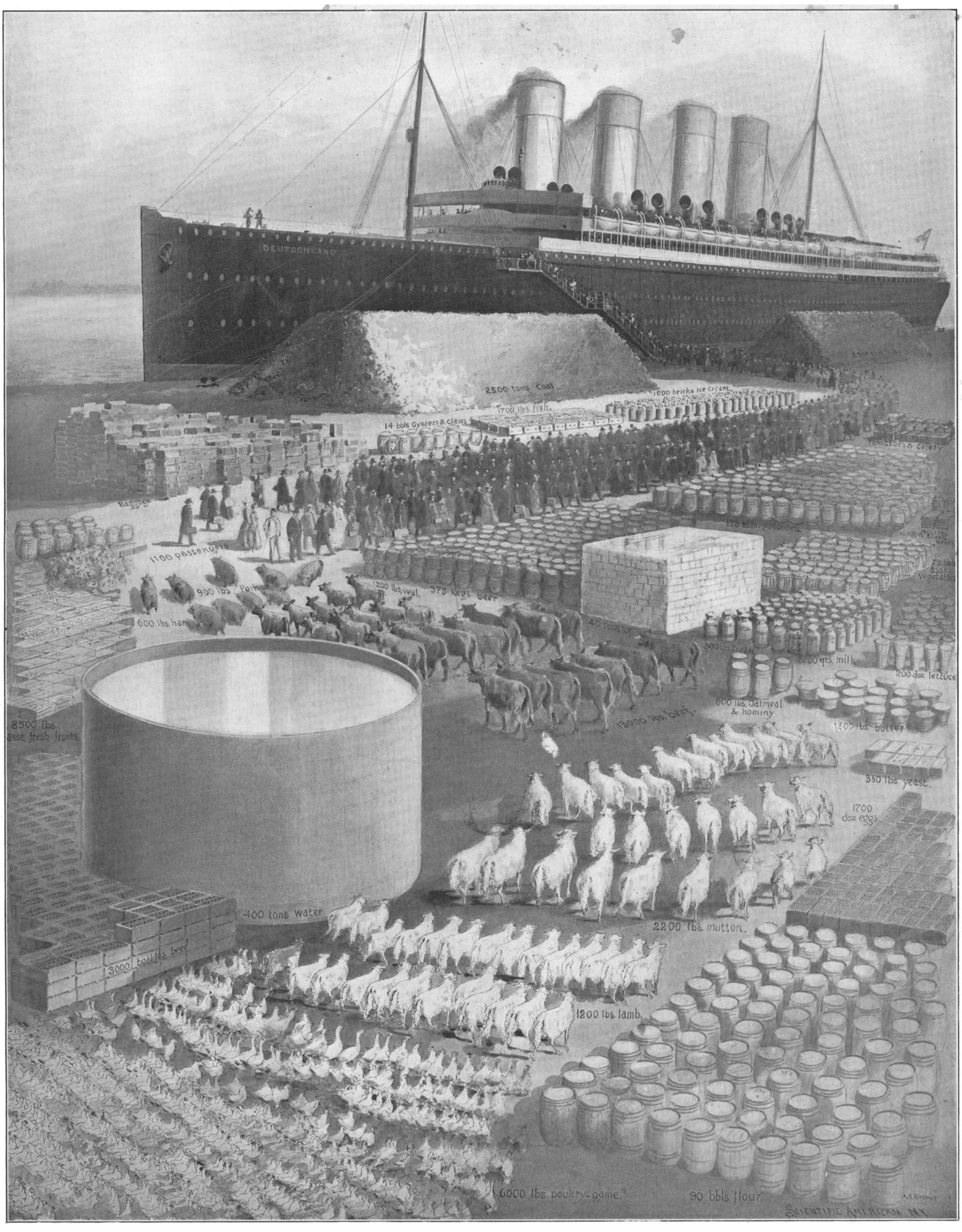

PROVISIONING A TRANSATLANTIC LINER—EQUIVALENT IN LIVE STOCK AND GENERAL STORES.—[See page 406.]

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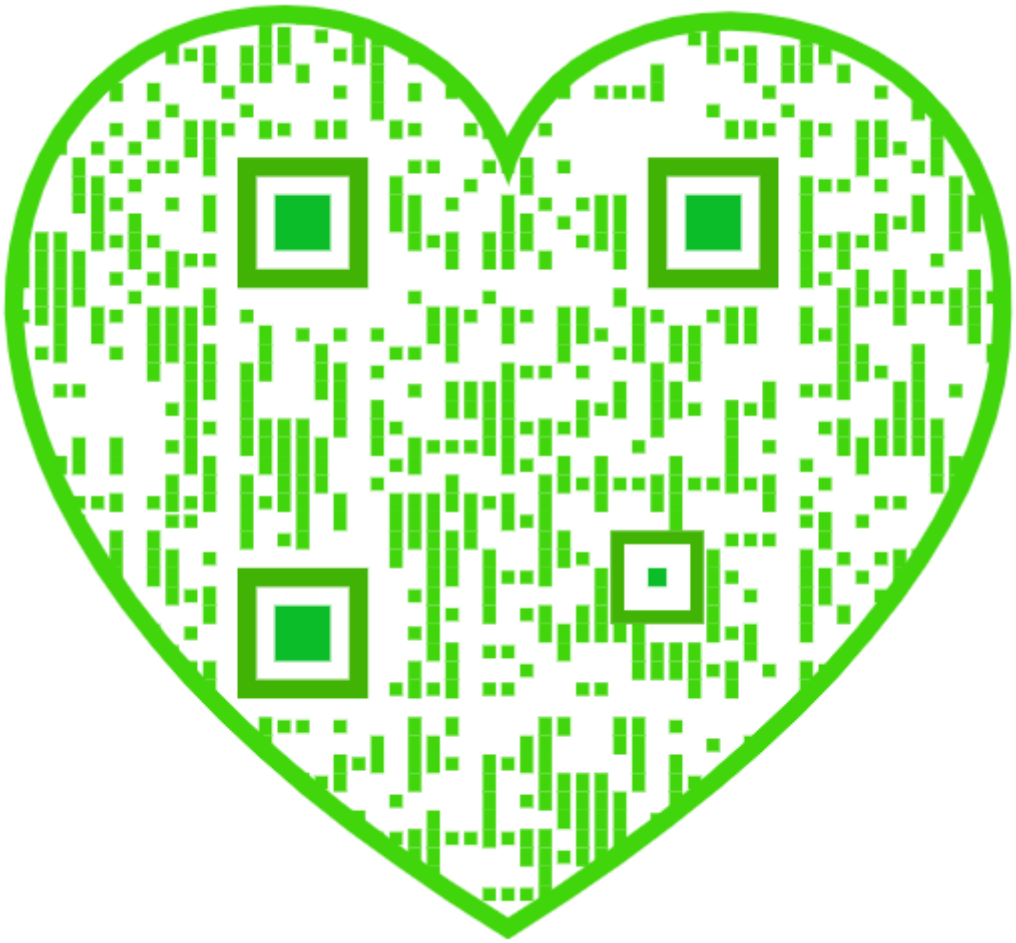

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NEW YORK, SATURDAY, JUNE 29, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

BIGGEST IN THE WORLD.

Is it because we never entirely lose some of the strong characteristics of childhood that, in describing an event or an object, we seem to consider that the last touch of dignity and importance has not been put upon it until it has been designated as the biggest or most superlative something or other of its kind in the world? It is really surprising how much heart-burning may be caused by a journalistic inadvertency, actual or supposed, in placing the coveted honor where it does not belong. A curious instance of an imagined injustice of this kind has lately reached the Editor's desk in the form of an editorial from our esteemed contemporary, The Daily Eagle of Poughkeepsie, N. Y., in which the writer takes us to task for having stated that the new double-track railway viaduct over the Des Moines River, Iowa, is in some respects the most notable railway viaduct in existence. This structure is 2,685 feet in length, and its rails are 185 feet above the water. The peace of mind of our Poughkeepsie contemporary has been rudely disturbed by our stating that this structure, "in point of the total weight of metal employed in its construction, is fully three times as heavy as the next largest bridge of the kind in the world." The statement is unpardonable in the eyes of our critic, who hastens to remind us that he lives beneath the shadow of a double-track railway bridge, which is 6,767 feet and some inches in length, and 212 feet above high tide, and contains a dead-weight of over 21,000 tons of steel as against the insignificant total of 5,680 tons that was built into the structure over the Des Moines River. The trouble with our contemporary is that he is comparing two horses of an entirely different color, namely, a viaduct and a cantilever, the Des Moines crossing being of the first and the Poughkeepsie crossing of the second type. In bridge engineering parlance it is customary to classify a bridge according to the predominant feature thereof. In the case of railway bridges, such as the Loa viaduct in Bolivia, and the Kinzua and Pecos viaducts in this country, where by far the greater part of the crossing is made up of short spans carried on steel bents or braced towers, with or without a truss span thrown across the main channel, or gorge, as the case may be, the structure takes its name from its predominant feature and is known as a viaduct, this term being generically applied to any tower-and-short-span structure of the kind described. On the other hand, a bridge of the character of the Forth cantilever structure in Scotland, or the Poughkeepsie crossing of the Hudson, in which the cantilevers form the predominant feature and the viaduct approach, great as it may be, is entirely subsidiary, the structure is generically known as a cantilever bridge. The same may be said of the new East River bridge, which, although it is approached by a viaduct several thousands of feet in length—of an aggregate length indeed much greater than that of the suspended structure—will nevertheless be known as a suspension bridge. For all its 4,000 and more feet of viaduct, the splendid structure at Poughkeepsie will ever be known as one of the great cantilever bridges of the world.

EXTRAORDINARY SPEED IN THE PARIS-BORDEAUX AUTOMOBILE RACE.

From Paris to Bordeaux by road is a distance of 348 miles, and when the great chauffeur Charron covered this distance in the race of 1900 in 11 hours 4 minutes and 20 seconds, at an average speed of 31.4 miles per hour, it was justly considered to be a most remarkable performance. This year, however, has witnessed a feat which is not only the most sensational in the annals of automobilism, but one of the most remarkable speed performances of any kind whatsoever, whether by road, rail or sea; for the same distance was covered by the winner in 8 hours 44 minutes and 44 seconds, at an average speed of about 40 miles an hour. The significance of this performance is only understood when we bear in mind that the Paris-Bordeaux course involves a reduction of running speed to about 7½ miles an hour in passing through ten different towns and cities along the route. If the 18 miles on which there is a speed restriction be deducted, we find that Fournier covered 330 miles in 6 hours 11 minutes and 44 seconds, at an average speed of more than 53 miles an hour. Remembering that in climbing the hills and on certain parts of the road where curvature or other local conditions would necessitate it, the speed must have been brought down very much below this average, we can see that, on certain stretches, the automobile must have been running at a speed of from 70 to 75 miles an hour—and this, be it remembered, upon a country macadamized road and not upon a carefully aligned steel track, fenced in from all the risks and dangers of miscellaneous traffic. Interest in this performance centers both in the man and the machine. The latter was a Mors vehicle of 35-horse-power, and, unprecedented as was this capacity, it was excelled in some of the other machines that were present at the starting line, the English automobilist Edge, for instance, being on hand with a 70-horsepower machine, which was disqualified on the ground that the tires, which had been substituted on account of a puncture, at the last moment, were of French and not of English make. The machine thereby failed to meet the conditions of the race, which demanded that each machine should have an absolutely national character. Judged on purely technical and mechanical grounds there is, of course, no reason why an automobile provided with sufficient horsepower should not maintain such high speeds and even higher speeds for as great and greater distances; and we say this without wishing to detract from the great credit which is due to the builders of the leading vehicles, several of which made better time than that accomplished by the winner of last year's race.

The most remarkable feature of the whole performance is the nerve and skill possessed by the chauffeur Fournier, for at the terrific pace achieved, it is evident that the slightest error in judgment could easily have precipitated disaster. Full details of the race will be read with considerable interest, particularly as regards the special policing, which must surely have been carried out at crossroads and elsewhere to maintain some kind of a clear track ahead of machines that were sweeping along at speeds faster than those of the average express train. Fournier is well known in this country. Only a couple of years ago he was a conspicuous figure upon the bicycle track at Madison Square Garden, where he exhibited a motor-cycle and introduced motor-pacing to the American public.

It is noteworthy that the leading automobiles were all heavy vehicles of great power, the first five being in the class weighing over 1,430 pounds. The winning machine was, as we have said, a Mors, and the second, third, fourth and fifth were Panhard vehicles. The sixth and seventh contestants to finish were 8-horsepower De Dion motor-cycles, the first covering the distance in 8 hours 1 3-5 minutes and the second in 8 hours 3 minutes. An average speed of over 40 miles an hour for 330 miles for a motor-bicycle is a scarcely less remarkable feat in its way than that of the winning machine.

THE LESSON OF THE RECENT FERRYBOAT DISASTER.

It is to be feared that the relatively small loss of life in the recent ferryboat collision in New York Harbor, small, that is to say, compared with the loss which might easily have occurred, may result in our too readily forgetting the lesson which this accident teaches. Had the Staten Island ferryboat been rammed by the "Mauch Chunk" when she was far from her berth, instead of being fortunately within reach of shoal water, the list of fatalities would probably have run up into the hundreds.

It is not for us to enter into the question of culpability in this accident: that will be decided by the proper authorities and the blame, if there be any, will be placed where it rightly belongs. Moreover, when we bear in mind the enormous number of passengers carried every year by our ferryboats, the crowded state of the New York waterways, and the fact that the ferryboats make their trips directly across the line of travel of incoming and outgoing ships, we must admit that the freedom from accident is something truly phenomenal and reflects the highest credit upon the skill of our ferryboat pilots. Shipping men from all over the world have commented upon the extraordinary care required in the navigation of the stretch of water that embraces the southern end of Manhattan Island, and have spoken in the highest terms of the skill which is shown by the captains and pilots of our local craft. Having said this much, however, there is one lesson of the "Northfield" disaster upon which we would lay very special emphasis, and this is that in view of the ever present possibility of collision, all ferryboats at the port of New York should be built with a view to their possessing a wide margin of flotation, their hulls being so subdivided by bulkheads that they would be incapable of being quickly sunk, as was the "Northfield," by a single blow beneath the water line. The more modern ferryboats, of course, are constructed on this plan; but there are some of the older boats around New York, which, if they should be run down, would have great difficulty in reaching shoal water before they sank. We trust that one result of this disaster will be the enactment of even more stringent regulations as to the construction and subsequent inspection of all craft employed in the ferry service around this city.

THE NEW CLYDE LINE STEAMSHIP "APACHE."

It is probably due to the great size and high speed of the transatlantic liners, and the interest of the American public in their performances, that we are in danger of forgetting that our American coastwise steamship companies are adding steadily to their fleets and putting some very serviceable and thoroughly up-to-date new boats upon the various routes. There sailed from this port last week the Cramp-built liner "Apache," the first of two sister ships which have been built by that company for the Clyde Line for service on the route between this port, Charleston, S. C., and Jacksonville, Fla. The "Apache," which is the seventeenth steamship of the company's fleet, is slightly larger than the "Comanche," "Algonquin" and "Iroquois," of the same service. She is 310 feet long, 46 feet beam and 31 feet deep. She is driven by triple-expansion engines with cylinders 25, 43 and 70 inches in diameter and 36 inches stroke, and is built to steam 15 knots when loaded to her full capacity of 3,000 tons of cargo. The staterooms are characteristically American, that is to say, they are spacious, well lighted and airy, and they are free from that too-profuse decoration with which modern passenger ships are apt to be overloaded. There is accommodation for 200 passengers, all of which is above the upper deck.

RECONSTRUCTION OF GERMAN CRUISERS

The German navy has recently undertaken an important piece of work, which consists in modifying a series of eight cruisers which form part of the fleet so as to increase their tonnage and bring the construction up to date. This is to be carried out in a somewhat novel fashion by lengthening the hull by some 25 feet, cutting it in the middle and adding a central portion. This has already been carried out with the first of the series, the "Hagen," and the results have proved so successful that there is little doubt that the remaining seven will be treated in the same manner. The series of cruisers includes the "Hagen," "Frithjof," "Beowulf," "Hildebrand," "Siegfried," "Heimdall," "Aegir" and "Odin." They are coast defense cruisers which were designed at a period when the German navy was mainly occupied with the defensive, and in consequence these boats, which were to navigate along the coast and keep within a short distance from supply points, carried only a small provision of coal, this being about 220 tons. Their displacement was reduced as much as possible, this being just sufficient to comply with the requirements of this class of boats. Six of these cruisers proved quite satisfactory in service, and gave proof of remarkable nautical qualities, and it was thereupon decided to increase the number from six to eight; the latter two had a displacement somewhat greater than the others, and the power and coal supply was thus increased. However, with the recent increase of the German navy and a new order of ideas, these boats were judged to be quite insufficient to figure in the present fleet. But if their radius of action was limited, their other qualities showed that they were fitted to perform the duties of first class cruisers, and it was accordingly decided to transform them by increasing their coal-capacity and thus add a series of boats to the fleet at a relatively small cost, and as the oldest of these dates only from 1889, they will be still quite modern. To increase the coal capacity, the displacement, and consequently the length of the boat, was to be increased. This operation, which is comparatively easy on an ordinary steamer, presents certain difficulties in the case of an armored vessel; in order to cut it in the middle and add the amount required for the increased displacement, it is necessary that as few of the parts as possible should be dismounted in the two halves, which should be left in their original condition, thus leaving in place the engines and boilers, etc. It was decided to commence the work with the "Hagen," and this was begun at the Kiel docks in September, 1899. The section was made in front of the engines, and the rear part was drawn back about 26 feet; the operation of moving the mass required less than an hour. The intermediate portion which was added represented a weight of 500 to 600 tons. In October, or about a year after the commencement of the work, the "Hagen" proceeded with its trials, with very satisfactory results; the engines and boilers acted well, and developed 5,230 horse power, the number of revo-

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lutions being increased to 142 per minute. The coal supply, owing to the increased displacement, has been raised from 220 to 500 tons, and a number of minor changes have been made which give the boat an up to date appearance. The coasting cruisers, when thus transformed, will be able to take an active part with the remainder of the fleet, and there is no doubt that the whole series will be thus treated. To transform the eight vessels will cost about five millions, according to calculations, this representing the cost of a single modern battleship, and the advantage is at once apparent.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The brightest stars in the summer skies are the ruddy Arcturus and the bluish Vega. At 9 P. M. on July 15 the former is some distance west of the zenith, and the latter somewhat nearer on the east. Between them lie the constellations of Corona Borealis and Hercules, the first of which consists of a semicircle of inconspicuous stars, and the second of a keystone-shaped group directly overhead, with outliers on both sides. South of these a large area is filled by the intermingled forms of Ophfuchus and Serpens, whose most characteristic configuration is a kite-shaped figure a little west of the meridian.

Close above the southern and southeastern horizon are Scorpio and Sagittarius. The bright red star Antares, and the long, curving line below it which forms the Scorpion's tail, cannot be mistaken; and Sagittarius, which is anyhow one of the more conspicuous zodiacal constellations, now includes within its borders both Jupiter and Saturn.

Aquila, marked by the brilliant Altair, with a fainter attendant on each side, is well up in the southeast. Below it is Capricornus, whose two brightest stars both show double in a field-glass. Cygnus is conspicuous in the Milky Way below Vega. Farther down on the right is the little group of Delphinus, often called "Job's Coffin." Pegasus and Andromeda are rising in the northeast. Of the circum-polar constellations, Cassiopeia is below and to the right of the pole, Cepheus higher up, Draco and Ursa Minor above the pole-star, and Ursa Major on the left. Leo, Virgo and Libra fill most of the western and southwestern sky.

The present is a good opportunity for the study of some interesting variable stars. First among these may be mentioned Beta Lyrae, which is the nearest to Vega of a pair of small stars which lie on the line joining it with Altair, about one-quarter as far as the latter. The changes of its brightness may be easily observed by comparing it with its neighbor, Gamma Lyrae. They are completed in 12 days 21¾ hours, during which time there are two equal maxima of brightness, separated by two unequal minima. Beginning at the first maximum, its magnitude is 3.4, about equal to Gamma. Then it falls nearly to the fourth magnitude, rises again to its original brightness, and descends once more to the 4½ magnitude, returning finally at the end of the period to its initial condition. The star's spectrum also shows remarkable peculiarities, containing both dark and bright lines, which are periodically displaced with reference to one another in such a way as to show that they are produced by two different bodies revolving about one another in a period equal to that of the light-variation.

The following explanation of the star's variability, deduced from the above-mentioned facts, is taken from an article by Mr. Myers, published some time ago in the Astrophysical Journal. Beta Lyrae consists of two stars, one about three-quarters the diameter of the other, revolving about one another, in a circular orbit, so close together that they almost touch. The plane of this orbit is inclined very little to the line of sight, so that the stars alternately eclipse one another. The smaller star is nearly twice as bright as the larger one.

At the principal minimum, the small star is behind the larger one, and only the light of the latter reaches us. Three days later it is on one side, and the combined light of both stars produces a maximum. After about three days more the small star is in front of the large one, hiding most of it. All the light of the small star and part of that of the large one reaches us, so that, though the star does not appear to us as bright as at maximum, it is much brighter than at the principal minimum. When the small star has moved off on the other side we have a second maximum. The actual velocities of the stars in miles per second can be determined from the spectroscopic observations, and thus it is found that the centers of the two stars are about 30,000,000 miles apart. The larger star is over 30,000,000 miles in diameter, and is about 21 times as heavy as our sun The diameter of the smaller one is about 23,000,000 miles, and its mass nearly 10 times that of the sun. Their bulk, in proportion to their mass, is enormous, so that they must be entirely gaseous and hardly denser than the earth's atmosphere at sea-level.

Two other short-period variables are now in good position for observation. On the upper edge of the Milky Way, about midway between Cygnus and Cassiopeia, is a triangle of small stars. The nearest one to Cassiopeia is Delta Cephei, which varies between the magnitudes 3.7 and 4.9 in 5 days, 8 hours and 48 minutes. The other two stars of the triangle are good "comparison stars."

To find the other variable, start with Altair. A line drawn from the small star above it through the fainter one below it, and continued as far again, bending sharply to the right, points out Eta Aquilae. The period of this star is 7 days, 4 hours and 14 minutes, its maximum magnitude is 3.5, and its minimum 4.7.

The variation of both these stars is of the same type. The brightness changes continuously, rising rapidly to the maximum, and falling off much more slowly toward the minimum. In the case of Eta Aquilae a slight rise to a secondary maximum interrupts the falling phase. Such variation evidently cannot be due to eclipses, as the times of fall and rise would in that case be nearly equal, since the eclipsing star would move off about as fast as it moved on.

The variation of both these stars is of the same problem. Both stars show variable velocity in the line of sight, and by study of this it has been found that each of them is revolving in a highly eccentric orbit about a dark body—or rather about the common center of gravity of itself and the dark body—in the same period as that of the light-variation. The minimum does not occur when the dark star is between us and the bright one, and so we have additional proof that it is not due to an eclipse. It is also clear that the orbit must be inclined to the line of sight so that the dark star passes to one side of the bright one instead of directly in front of it, as otherwise we should have an eclipse and a second minimum.

The accepted explanation of the variability of these stars is that it is due to tidal action. The attraction of the dark companion must produce enormous tides in the liquid—or, most probably, gaseous—mass of the central star. Owing to the eccentricity of its orbit (which is about the same in both cases under consideration), the least distance of the dark body is but one-third of its greatest, and, since the tide-raising force varies inversely as the cube of the distance, it is 27 times greater at one time than at the other.

As the two bodies approach one another, the increasing disturbance of the atmosphere of the luminous one increases its brightness, the effect reaching its maximum shortly after the passage of the nearest point, or periastron. With the decrease of the tidal force the bright star gradually cools down, rising again only when the return of its satellite stirs up once more its central fires.

THE PLANETS.

Mercury is in Gemini, and is evening star till the 12th, when he passes between us and the sun, and becomes morning star. He can only be seen in the last days of the month, just before sunrise.

Venus is evening star, and is gradually coming out from behind the sun into a more conspicuous position, remaining above the horizon more than an hour after sunset.

Mars is evening star, being well past the meridian at sunset. He is more than twice as far from us as he was in February and only about one-sixth as bright, and is still retreating and growing fainter as he moves eastward from Leo into Virgo.

Jupiter is just past opposition, and at his nearest for the year. He is by far the most brilliant object in the southern sky, and his disk and satellites are easily visible with a field-glass.

Saturn is in Sagittarius, close to Jupiter. He is in opposition on the 5th. His rings are seen at the greatest possible angle and form a splendid telescopic sight, in spite of his low altitude.

Uranus is in Scorpio, about 8 degrees northeast of Antares. Neptune is in Gemini, too near the sun to be visible.

Full moon occurs on the morning of the 1st, last quarter on that of the 8th, new moon on that of the 15th, first quarter on the night of the 22d, and full moon once more on that of the 30th. The moon is nearest us on the 11th, and farthest on the 23d.

She is in conjunction with Jupiter on the afternoon of the 1st, Saturn the next morning, Mercury on the 14th, Neptune on the 15th, Venus near moon on the 17th, Mars on the morning of the 21st, Uranus on the night of the 26th, and Jupiter and Saturn once more on the night of the 28th and morning of the 29th.

DEATH OF T. C. CLARKE.

Mr. Thomas Curtis Clarke, one of the best-known civil engineers and bridge-builders, died in New York, June 15, in his seventy-fourth year. He was trained to be a civil engineer and early in life engaged in various kinds of railroad work, but finally made bridge engineering a specialty, and his name is identified with many of the most important bridges built in the United States. One of the first of his works in this line was the building of the C., B. & Q. bridge at Quincy, Ill. In the piers and foundations of this bridge, Mr. Clarke was among the first of American engineers to use concrete upon a large scale. Mr. Clarke was the senior member of the firm which afterward became the Phoenix Bridge Company. Among the famous works on which he was engaged was the erection of the Kinzua Viaduct. In 1884 Mr. Clarke became one of the members of the Union Bridge Company, which soon became the largest concern devoted to bridge-building in the world. While Mr. Clarke was connected with this company they built the famous Hawkesbury Bridge in Australia, which is one of the first cases where a bridge was built in a foreign country by an American concern. He also had special charge of the Poughkeepsie Bridge. It is stated that Mr. Clarke had been concerned in the building of over eighty miles of bridges and viaducts. He was well known as a writer upon professional subjects.

SCIENCE NOTES.

The Baldwin-Ziegler polar expedition will start shortly for the north.

Mr. Morris K. Jesup has perfected an arrangement by which the American Museum of Natural History and the South Kensington Museum will exchange exhibits.

The Arnold Arboretum, in the suburbs of Boston, has carried on its highly interesting and important work on a very slender income. Steps are now being taken to raise $300,000 in addition to the present endowment.

The Massachusetts Institute of Technology has held examinations in London for the entrance of pupils to the Boston institution. The London Engineer says: "It would seem that American competition is not to be confined to commerce in the future."

Prof. Nicols Finsen, the inventor of the light cure for lupus, has been summoned to London by the Queen of England to superintend the administration of the apparatus which her Majesty presented to the London Hospital. The Belgian government also proposes to install the cure at Brussels, and Prof. Dubois has been dispatched to Copenhagen, to become acquainted with its application.

The invention of the mariner's compass by Flavio Gioja is to be celebrated this summer at Amalfi, Italy. Gioja came from Positano in the hills back of Amalfi. There have not been wanting those who contend that the invention, like most others, was gradual, and that the tendency of the magnetized needle to point north was known long before Gioja's time, it even having been familiar to the Chinese.

Prof. Henry Truman Henry Safford, an eminent mathematician and astronomer, died recently at Williamstown, Mass. He was born in 1836 and was known in his early youth as the "Vermont boy calculator." In 1866 he was appointed Director of the Astronomical Observatory at Chicago. From 1869 to 1871 he was engaged upon the great catalogue of stars then in course of preparation by the co-operation of European and American astronomers. This work was interrupted by the Chicago fire of 1871. He prepared a star catalogue which was published by the War Department. He did considerable work in relation to latitude and longitude.

John D. Rockefeller has given $200,000 to found "The Rockefeller Institution for Medical Research." The gift is not for an endowment fund, but for immediate expenditure. Mr. Rockefeller has for some time been consulting with eminent medical men as to the need of such an institution, and he has had the best of advice. Facilities for original investigation are to be provided, especially in such problems in medicine and hygiene as have a practical bearing on the prevention and treatment of disease. The first work of those connected with the institution will be that of co-operating with the Board of Health in studying its work and the problems confronting it, particularly that of milk supply. Work of a more ambitious nature will be begun in the fall under the guidance of experienced investigators.

In Europe it has been found rather difficult to introduce the circuit-system for the transmission of meteorological messages for a time after each observation. In the United States this is very easily accomplished, but in Europe, where the control of the wires is in the hands of different governments, the difficulty of introducing a similar method is almost unsurmountable. The system recommended by the Deutsche Seewarte is called the radial system, in which the observations pass through the central offices. Special observations have been made for nearly a year at eight A. M., mid-European time, at some thirty-five stations in various countries, including several in the British Isles, and forwarded to the Deutsche Seewarte, which enables the Hamburg office to issue reports as early as nine A. M., and the early publication of this information has been found to lead to such satisfactory results as to warrant a considerable extension of the plan in the near future.

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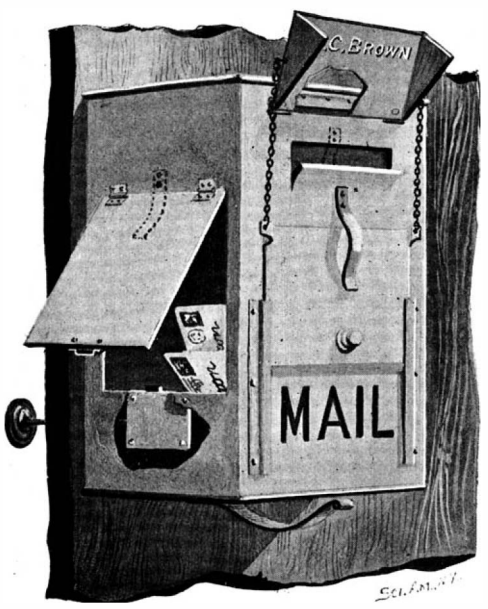
A NOVEL HOUSE MAIL-BOX.

Our illustration pictures a mail-box which was devised by Mr. Clayton P. Myer, of Silsbee, Tex., for the purpose of facilitating house-to-house delivery and of indicating that mail has been delivered.

The arrangement comprises essentially a box provided with a hinged hood for the letter-receiving slot, which hood when lifted operates a slide by means of chains, to expose the word "Mail," thereby showing that mail of some kind has been delivered. The slide is held in its raised position by a spring, and is restored to its normal position by hand.



AN IMPROVED MAIL-BOX.

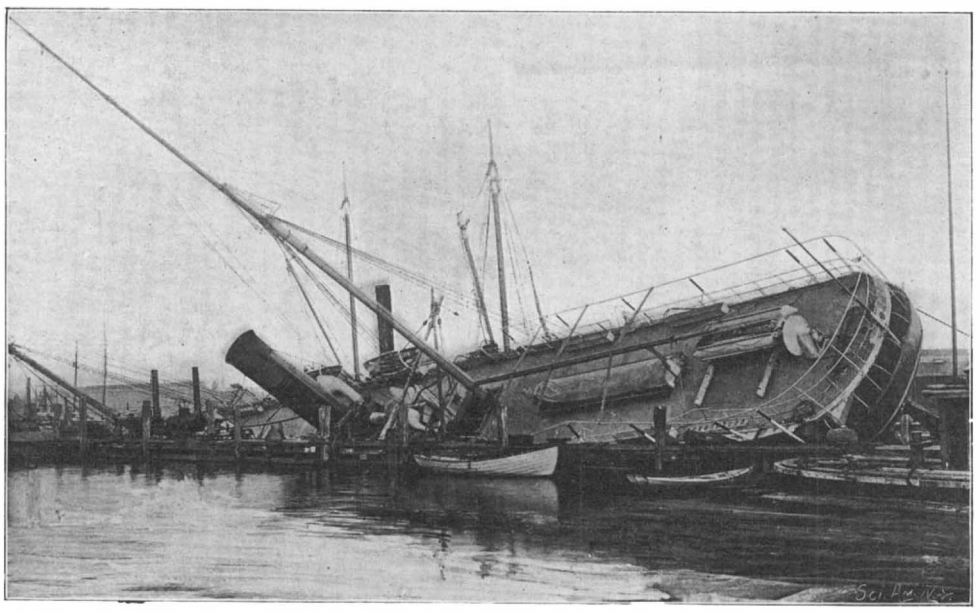
The box is also provided with a door through which the mail is removed. The door is controlled from the inside of the house, thereby rendering it impossible to open the box without entering the house. A lock controlled by a shaft holds the door closed. Upon turning the shaft, the door is pressed open by a spring. For the reception of bulky mail, a spring-arm is attached to the bottom of the box. The contrivance is cheap, neat, rain and dirt proof, and secure from thieves.

CURIOUS DOCKING ACCIDENT.

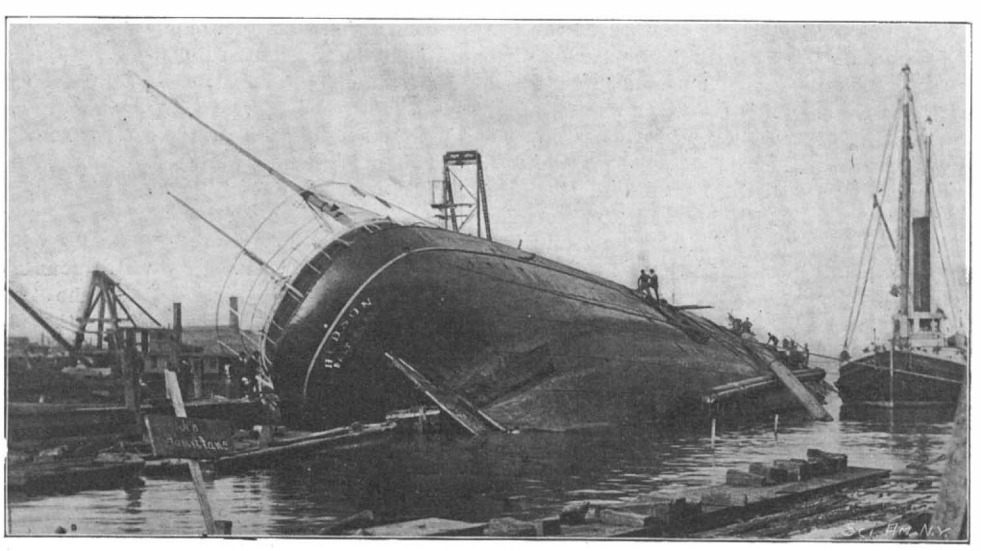
The illustrations herewith produced give an idea of the accident which recently occurred at Baltimore when the steamship "Hudson" careened while being docked, falling partly upon her side. She was being hauled out on the marine railway at the dock of Messrs. William Skinner & Son, in order to make repairs to a bent propeller blade. The ship was left on the railway with the stern entirely out of water with the exception of about one foot. The work of hauling her out began at high tide, and the after portion of the hull was held in a perpendicular position by driving posts under the rear quarters for shoring. The tide rises and falls about 18 inches at this point, and at low tide so much of the hull was exposed as to overcome, in spite of the supports, the equilibrium of the vessel, and, falling to the left, she struck the side of the dock, breaking down portions of the superstructure. The deck railing was broken and a part of the rigging supporting the masts on the port side was cut away; some of the upper plates in the hull also being bent inboard. Below the water-line the divers found her perfectly tight. The incline of the marine railway is such that, in heeling over, the "Hudson" forced her bows under water to a distance of about fifteen feet from the cutwater.

One of the steamers of the Merritt Wrecking Company was sent for, and the first step toward righting the vessel was to pump out the water which entered the hull through the port windows and forward hatchway. The next step was to stretch cables from the masts and deck stanchions to powerful tugs in the harbor and to the wrecking steamer, and endeavor to pull her out by the bow into deep water. This failing, weights are to be attached to the starboard side of the vessel, and an attempt will be made to pull her over onto an even keel by a system of cables attached to windlasses connecting with the engine of the marine railway.

Fortunately, the hull of the vessel was empty at the time she was docked; but the work of righting her will, nevertheless, be attended with considerable difficulty, as she is 287 feet in length, 34 feet beam and has a net register of 1,300 tons. She has a cargo capacity for about 2,500 tons of freight and accommodations for sixty passengers. The engines and most of the machinery are located amidship.



VIEWED FROM THE PORT QUARTER.



STEAMSHIP "HUDSON," CAPSIZED ON A MARINE RAILWAY AT BALTIMORE.

Photographic Printing in Two Colors.

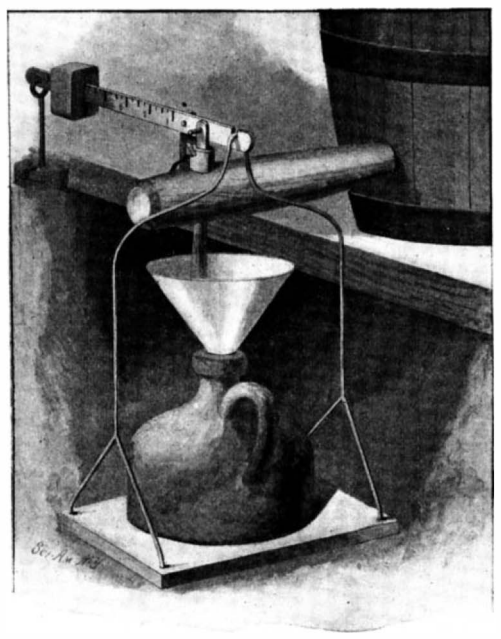
A new method of photographic printing upon paper in two colors has lately been devised by M. Bolle. By this means images may be printed side by side in different colors and an agreeable effect thus produced; it is especially applicable in the case of a central image surrounded by a border of a second color. One of the images is printed from a photographic negative and the second from a negative prepared from a hand design. The method is based upon the combination of the ferro-prussiate (blue print) and the bichromated gum process, and gives a blue image combined with another whose color may be varied according to the taste of the operator. To obtain the blue image the paper is sensitized by a mixture of the two following solutions:

A. Citrate of iron and ammonia . . . 15 parts or 15 grains.
   Water . . . . . 50 parts or 50 minims.
B. Ferricyanide of potassium . . . 8 parts or 8 grains.
   Water . . . . . 40 parts or 40 minims.

These solutions, prepared and filtered, may be mixed in advance and kept in yellow bottles, but it is best to mix at the time of using. The image is strongly printed and developed by washing in water till the whites become pure. The second image may form, for instance, a border for the blue image. To obtain it a plate is first prepared by exposing an ordinary gelatine plate to daylight and developing it until it is entirely black. The design to be reproduced is copied or traced upon tracing paper and transferred to the plate by impression paper. It is then engraved through the film with the point of a needle, giving a negative in black and white. To print this design the border of the blue image is sensitized by brushing over it a thin and even layer of gum arabic, 40 per cent solution, to which is added a sufficient quantity of the color decided upon. When this layer is dry a sensitizing solution of bichromate of potash (10 per cent) is applied in the same way. The printing is carried out as usual and the image developed by washing in cold or lukewarm water. This process may be modified in different ways and will find many applications; if desired, the center of the image may be printed by the latter method and the margin in blue, or different images may be printed side by side.

A SELF-CLOSING SPIGOT OR FAUCET.

To provide a means for automatically closing a faucet or tap when a predetermined quantity of liquid has been drawn from a cask is the purpose of a device invented by Mr. David M. Bredin, of Picton, Canada. On the spigot a scale-beam is fulcrumed, the shorter arm of which supports a platform for the vessel to be filled, and the longer arm of which carries a counterpoise which can be shifted. The counterpoise is adjusted at a point determined by the weight of the liquid which is to be drawn from the cask. When the desired amount of liquid has flowed into the vessel, the shorter arm of the scale beam descends automatically, closing the spigot by the operation of a plug. By means of a spring latch the plug is prevented from opening the spigot during the removal of the vessel.



AN AUTOMATIC FAUCET.

New Methods of Packing Butter for Shipment.

Our Consul, Mr. Hughes, of Coburg, under date of April 26, 1901, sends the following description of a new method of packing butter for long shipments:

A light wooden case or box is lined thoroughly at the bottom and sides with a layer of plaster of paris one-fourth of an inch thick, on which common glass slabs, with their edges fastened together by gummed paper, so as to make a perfect-fitting box, are placed. In this box the butter is placed, packed in good waterproof paper, in 10-pound packages. The glass top is then put on and sealed carefully with gummed paper bands, so as to make the box air-tight. A one-fourth-inch layer of plaster of paris is then put over this and the wooden cover nailed on. Each of the cases is made to contain about 200 pounds of butter. The plaster of paris being a non-conductor, very little heat reaches the butter, which arrives at its destination in good condition. The Consul is informed that very successful results have been obtained by shipping butter packed in this manner from Melbourne to Kimberley—rather a severe test.

The Diatto surface-contact system does not appear to be working very successfully in Paris. There have been so many accidents and breakdowns that a committee was appointed to inquire into the trouble, and it reported that the damage was due to several causes. First, insufficient drainage of the surface-contacts and conduits, causing shunt currents; second, to unsatisfactory insulation; third, to a deposit of carbon caused by sparking; fourth, bad insulation of the cables.

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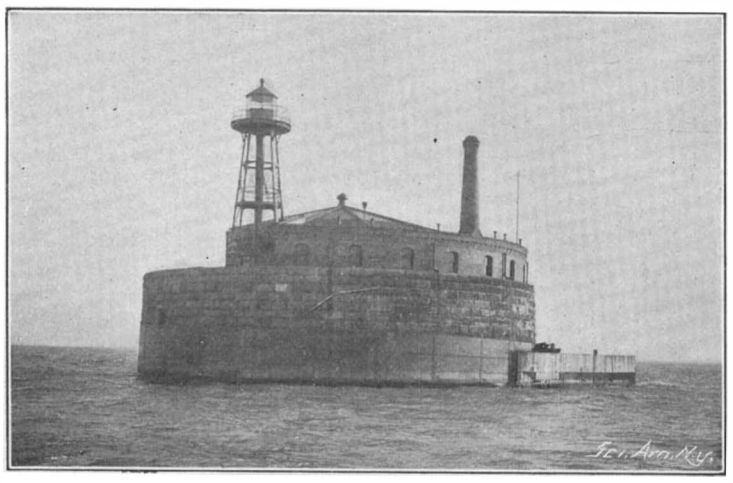
THE WATER SUPPLY SYSTEM OF CHICAGO.

BY F. B. EMBREE.

It is not yet three-quarters of a century (November 10, 1834) since the Board of Trustees of the infant Chicago paid $95.50 for the digging of a well as a means of water supply. Outgrowing that, in January, 1836, the Chicago Hydraulic Company was incorporated by the State Legislature and given a charter which was to continue in force for seventy years, by the provisions of which lake water was to be furnished to Chicago. The works of this company were put in operation in the spring of 1842. They comprised a reservoir, about two miles of wood pipe and a 25 H. P. engine, the whole costing about $24,000.

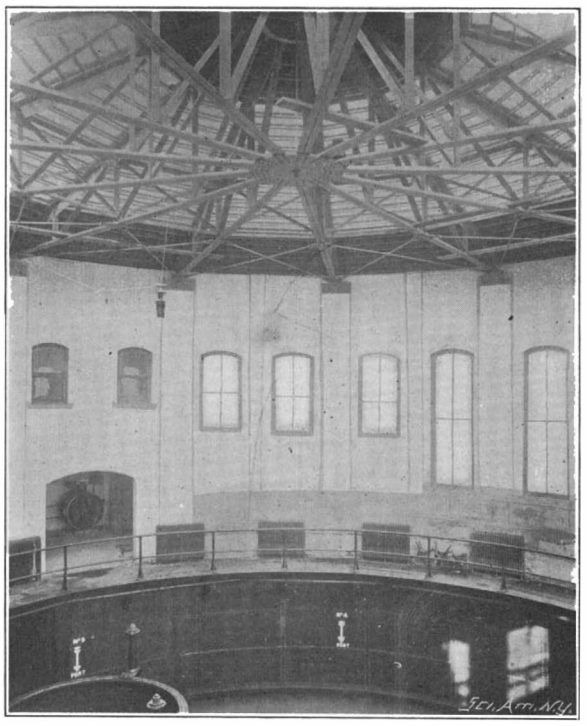


THE INTAKE CRIB COMPLETED.

This company, however, supplied only a portion of the south and west divisions of Chicago, and did not reach the north division at all. The inhabitants of the unsupplied sections were furnished with water either from the river, or by the "water-cart system" from the lake. Finally it became clear that the whole water supply needed to be managed by the city, and compromises having been agreed upon between the company and the city in 1852, the latter put its works into operation immediately.

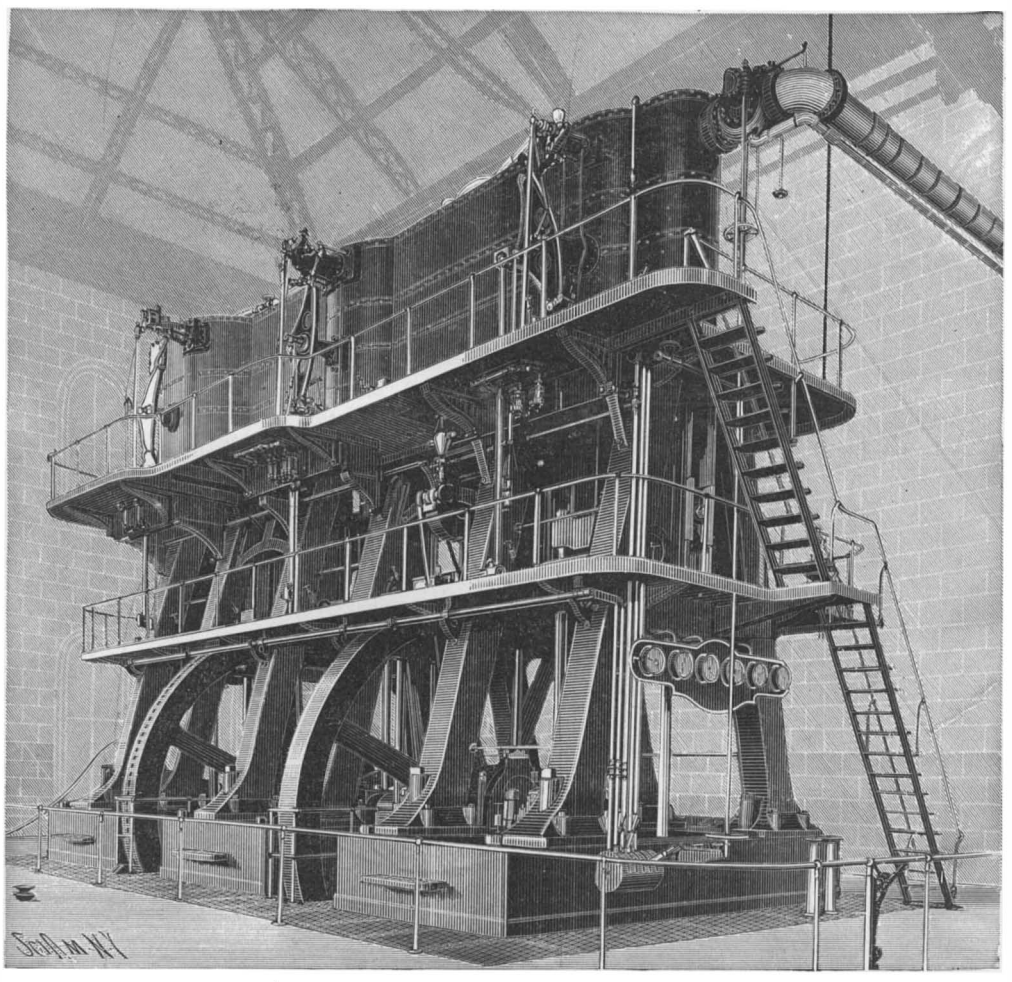
The north side pumping station at the foot of Chicago Avenue was the first station to be established. It began work in December, 1853, with a capacity of 8,000,000 gallons every twenty-four hours. The water came from an inlet basin on the lake shore cut off from the lake by a semi-circular breakwater with an opening to the southeast. There were three reservoirs holding from two to three days' supply. They were at LaSalle and Adams Streets, Chicago Avenue and Sedgwick Street, and Monroe and Morgan Streets. The first iron distribution pipe, 4 inches in diameter, was laid in 1852. In 1887 a shore-inlet tunnel 7 feet in diameter and 1,500 feet long, with an inlet shaft protected by a crib opposite to the north side station, was completed for use when the supply was endangered by ice, or from any other cause, at the two-mile crib. The addition of needed engines and other facilities to the north side station has kept this, the oldest and largest station in the city, in efficient use up to the present time. In 1869 the greater part of the station as it is to-day was finished. The style of architecture is castellated Gothic with heavy battlemented corners, executed with solid, rock-faced, ashlar stone and cut trimmings, with details of a massive and permanent character. The tower is the most imposing feature of the structure, and in the days preceding the sky-scraper epoch, a view of the lake and city from its top was thought to be very fine. A new lake tunnel, 7 feet interior diameter, extending from the crib to the north side station, was finished July 3, 1874, and in October of the same year it was extended under the land to the new pumping station at Ashland Avenue and Twenty-second Street (the west side station).

On November 6, 1876, the year in which the "Board of Public Works" was succeeded by the "Department of Public Works," with a single responsible head, the west side pumping station was put in operation, its capacity being 30,000,000 gallons per day. In 1884 this was raised to 60,000,000 by the addition of two new engines. The growth of the city's needs and the constant outlay necessary to satisfy them may be seen when this amount is compared with that actually pumped at this station for the year 1899, the amount reaching the enormous output of 19,281,301,400 gallons. It will be remembered that the first inlet basin to supply Chicago with water was quite near the shore, and although the city grew rapidly and packing houses and distilleries added their refuse to the Chicago River, and complaint was made by the citizens that the source of their water supply had become contaminated, no effort toward change was made until 1861, when the Board of Public Works entered upon its duties. A plan of filtration was first experimented with, but it was soon cast aside as impracticable, and it was decided to construct a tunnel, which would bring lake water from a distance sufficiently removed from the contaminating river deposits to insure its purity. It was thought that this could be accomplished by using a tunnel two miles in length. The horizontal diameter of the tunnel was fixed at 5 feet, that size offering a capacity sufficient to furnish 50 gallons of water per day to each person in a population of one million. Work was begun on this tunnel March 17, 1864, the introduction of pure lake water into the finished waterway being celebrated with appropriate public ceremonies March 25, 1867.



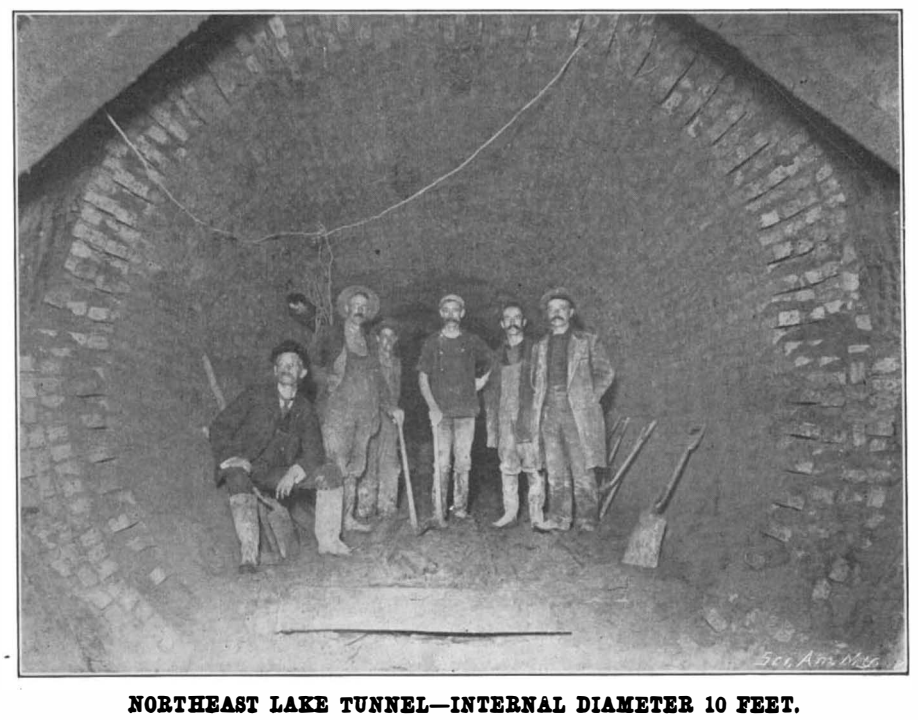
INTERIOR OF THE CRIB.

The present system of water pipe tunnels under the Chicago River was not originated until 1869. An accident occurred August 18 of that year, in which the water main crossing the river at Chicago Avenue was broken by the dragging anchor of a vessel, and the west side thereby deprived of water for



THE FOURTEENTH STREET PUMPING STATION.

NORTHEAST LAKE TUNNEL—INTAKE CRIB DURING PROCESS OF ERECTION—THE PARAPET.



NORTHEAST LAKE TUNNEL—INTERNAL DIAMETER 10 FEET.

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three days. This brought out the necessity of tunnels under the river bed. Up to this time all pipes at intersections of the river had been laid on the river bottom. But the pollution of the water continued, and when the construction of the next tunnel was planned, in 1887, it was decided to make it 8 feet in diameter and to extend it four miles into the lake. The initial work was done in the same year on a shore shaft at the foot of Peck Court. The land ramifications connecting the shore shaft with the south side and central stations were nearly completed in 1888, but it was not until December 15, 1894, that the immense work, up to that time the greatest engineering enterprise undertaken by the city, was completed. The interdependence of pumping stations and feeding tunnels prevented the central pumping station at Harrison Street from doing full work before the four-mile tunnel was in operation, although it began service July 14, 1890. The Fourteenth Street station was built in 1890, and re-equipped in 1898.

But increased as were the facilities for water supply, the growth of Chicago afforded no chance for a breathing spell for the water supply department. July 15, 1889, the suburban towns of Hyde Park, Lake, Jefferson, and Lake View were annexed to Chicago, adding to its population 220,000 souls, and to its water works system the pumping stations of Sixty-eighth Street and of Lake View; one lake tunnel 6 feet in diameter and 8,000 feet long with a submerged inlet for Hyde Park and Town of Lake; one lake tunnel in process of construction, 6 feet in diameter, for Lake View and Jefferson, and about 350 miles of water pipe. Immediate extensions and repairs for the adequate water supply of this new territory were imperative. The original plans of the Lake View water department contemplated a tunnel 6 feet in diameter extending easterly from the foot of Sulzer Street to a point one mile from shore. After annexation and while the work was in progress, it was decided to extend the tunnel a mile further. In order to utilize the construction as soon as possible a temporary crib was sunk 6,000 feet from shore on the line of the tunnel and water obtained from this point, work meanwhile progressing from a temporary shaft to the outer or permanent in-take crib previously sunk. This tunnel was completed in July, 1896, and the intermediate crib abandoned and finally removed in 1899. The construction, appointment, and furnishing of the Carter H. Harrison crib mark it as the most modern and efficient of the Chicago cribs. Its cost, including substructure, superstructure, and landing, was $192,441.40.

In 1895 it was again found necessary to plan for the construction of two additional pumping stations to relieve the sufferings of the remote west and northwest sections of the city due to an inadequate water supply. As a feeder for these, it then became necessary to build a new lake tunnel, which is divided into a lake section and three other sections covering the land ramifications. The lake tunnel extends to the Carter H. Harrison crib, and was completed in January, 1899. Section one of the land tunnel was completed in 1897, number two and number three in 1900. The capacity of the lake tunnel is 200,000,000 gallons per 24 hours, and the cost of the new service was $4,986,266.37. With the completion of the new tunnels and pumping stations a population of 3,500,000 can be supplied with 150 gallons of water per day to each person, and there will still be ample reserve machinery.

PROVISIONING A TRANSATLANTIC LINER.

Not by any means the least impressive evidence of the huge size to which the modern transatlantic steamship has grown is to be found in the graphic representation, on the front page of this issue, of the bewildering amount of provisions that have to be taken aboard for a single trip across the ocean. A mere tabulation of the various kinds of food which go to replenish the ship's larder, during the few days which she spends in port, fails to convey any adequate idea of the vast amount of stores taken aboard. Our pictorial representation is, of course, purely imaginary, particularly as regards the live stock; the beef, mutton, game, etc., being received on the ship in the dressed condition, no live stock whatever being carried. The drawing was made up from a list of the actual amount of provisions carried on a recent eastward trip on the Hamburg-American liner "Deutschland," and the number of live stock which contributed to meet the supplies for one voyage was estimated from the actual number of cattle, sheep, etc., that would be required to make up the total weights in dressed meats given in the table. With the exception of the live stock, the provisions are shown in the actual shape in which they would be taken on board.

The dimensions of the vessel are: Length, 686 feet; beam, 67 feet, and displacement, 23,000 tons; her highest average speed for the whole trip is 23.36 knots, and she has made the journey from Sandy Hook to the Lizard in five days, seven hours and thirty-eight minutes. In considering the question of feeding the passengers on a vessel of this size, the thought is suggested that there are other hungry mouths within the hull of the ship besides those to be found in the dining saloons of the passengers and the messrooms of the crew; mouths that are so voracious that they require feeding not merely at the three regular meal hours of the ship, but every hour of the day and night, from the time the moorings are cast off at one port until the vessel is warped alongside at the other. We refer to the 112 furnaces in which the fuel of the sixteen boilers in the boiler-room is consumed at the rate of 572 tons per day. Now, although the voyage from New York to Hamburg lasts only six or seven days, according to the state of the weather, the bunkers of the ship are constructed to hold a sufficiently large reserve of coal to cover all contingencies, her total coal capacity being about 5,000 tons; and at each voyage care is taken to see that they are pretty well filled.

The total number of souls on board of the vessel when she has a full passenger list is 1,617, made up of 467 first cabin, 300 second cabin, 300 steerage and a crew of 550, the crew comprising officers, seamen, stewards and the engine-room force. Sixteen hundred and seventeen souls would constitute the total inhabitants of many an American community that dignifies itself with the name of "city," and it is a fact that the long procession which is shown in our illustration, wending its way through the assembled provisions on the quay, by no means represents the length of the line were the passengers and crew strung out along Broadway or any great thoroughfare of this city. If this number of people were to march four deep through Broadway, with a distance of say about a yard between ranks, they would extend for about a quarter of a mile, or say the length of four city blocks.

To feed these people for a period of six days requires, in meat alone, the equivalent of fourteen steers, ten calves, twenty-nine sheep, twenty-six lambs, and nine hogs. If the flocks of chickens, geese and game required to furnish the three tons of poultry and game that are consumed were to join in the procession aboard the vessel, they would constitute a contingent by themselves not less than 1,500 strong. The ship's larder is also stocked with 1,700 pounds of fish, 400 pounds of tongues, sweetbreads, etc., 1,700 dozen eggs and 14 barrels of oysters and clams. The 1,700 dozen of eggs packed in cases would cover a considerable area, as shown in our engraving, while the 1,000 bricks of ice cream would require 100 tubs to hold them. Of table butter there would be taken on board 1,300 pounds, while the 2,200 quarts of milk would require 64 cans to hold it, and the 300 quarts of cream 8 cans.

In the way of vegetables there are shipped on board 175 barrels of potatoes, 75 barrels of assorted vegetables, 20 crates of tomatoes and table celery, 200 dozen lettuce; while the requirements of dessert alone would call for 4¼ tons of assorted fresh fruits. For making up into the daily supply of bread, biscuits, cakes, pies, and the toothsome odds-and-ends of the pastry cook's art, there are taken on board at each trip 90 barrels of flour, each weighing 195 pounds, this item alone adding a weight of 8½ tons to the cooks' stores. To this also we must add 350 pounds of yeast and 600 pounds of oatmeal and hominy.

Under the head of liquids the most important item is the 400 tons of drinking water, whose bulk is adequately represented by the circular tank shown in our engraving. This is supplemented by 12,000 quarts of wine and liquors, 15,000 quarts of beer in kegs, besides 3,000 bottles of beer. Last, but not by any means least, is the supply of 40 tons of ice.

Of course, it will be understood that, as in the case of the coal, it is not to be supposed that all of this supply will be consumed on the voyage. There must be a margin, and a fairly liberal margin, of every kind of provision. Moreover, the extent to which the larder and cellar are emptied will vary according to the conditions of the voyage. In tempestuous weather, where the trip is a succession of heavy gales, and the dining room tables are liable to be practically deserted for two or three days at a stretch, the consumption will be modified considerably. Stormy voyages of this character, after all, occur at infrequent intervals, and as a rule the supplies are pretty well consumed by the time the passage is over.

Fire from Waste Paper.

The deterioration in the quality of paper increases the liability of fire wherever waste paper is accumulated in any quantity. Most modern paper is made from wood and other vegetable fibers which, chemically, are not very different from the component material of a hayrick. If the waste paper is stacked in large quantities, and especially if it happens to be a little damp, heating takes place just as with a prematurely stacked hayrick, and spontaneous combustion may at any time break out in flame, as it has often been known to do in the farmyard, and of late years the greatest care and vigilance has been necessary to guard against it.

Engineering Notes.

Ten American locomotives have just been delivered to the Paris-Lyons Railway.

Acetylene black produced from the carbon of acetylene is of excellent quality, fineness and purity. By reason of its very fine division acetylene black seems particularly suited for the production of India ink.

During the year 1900 the shortest passage of a sailing ship from London to Calcutta was 82 days, and the longest 199 days. The shortest passage from London to San Francisco was 109 days, and the longest 203 days. The shortest trip from San Francisco to London was 96 days, and the longest 181 days.

A new solder is being introduced by an English concern. It consists of an alloy composed of pure metals mixed in the most efficient proportion, and incorporated with it is the necessary amount of rosin. The solder is made in the form of a tube with a narrow bore, the central cavity being occupied by the flux.

We learn from The Engineer that railway unpunctuality is by no means unknown in Russia. On the Vistula line in 1900, out of 348,933 trains which were run, 52,020, or 15 per cent, left the station before time; 74,909, or 21 per cent, arrived late. The other lines have not much more to boast of. The only fairly punctual line is the Warsaw-St. Petersburg one, on which only 7 per cent of the trains were late.

Arrangements are in progress for the visit of a representative commission of British artisans to this country. It will be their business to make a tour of observation among our varied industries. The commission has been organized through the medium of a London weekly called "Red Letter." The men are elected by popular vote. Their itinerary will include a visit to the Pan-American Exposition.

When the British Chancellor of the Exchequer levied the tariff of twenty-five cents upon each exported ton of coal, it was maintained by the various colliery owners that a heavy blow had been dealt to the English industry. As a matter of fact, however, since the duty was imposed the exports of coal from Great Britain have increased considerably, especially to Germany and France. During the month of April 620,000 tons of coal were shipped to France, while the quantity for the first four months of the present year aggregates 1,882,880 tons, representing a value of $7,737,400. The shipments to other parts of the Continent have been equally heavy.

A Baltic-White Sea Canal is proposed in order to more rapidly develop the vast territory of Archangel. It is contemplated to build the canal large enough to admit vessels of ocean tonnage. The canal would also be of great value to the Russian navy in time of war. If it is carried out, the total length of the canal will be 598 miles; 304 miles of the route will be formed by lakes. The canal will follow the bed of the Neva as far as St. Petersburg, crossing Lake Ladoga and following the Svir, which unites Lakes Ladoga and Onega. Different watercourses will then be utilized, the channels being enlarged and deepened until the White Sea is reached at Soroskaya. It is estimated that the work can be completed within a year, and that the cost would be $10,300,000.

A scheme for supplying the manufacturing districts of South Staffordshire with gas made by the patent Mond process is being considered by the British government. The gas is not to be employed for illuminating purposes, but is to be devoted to heating and manufacturing requirements entirely. The Mond gas is manufactured from an inferior quality of coal at a very cheap rate. The President of the Society of Chemical Industry of Great Britain, who is interested in the scheme, stated before the Parliamentary Committee that whereas now 50,000,000 tons of coal are annually consumed for manufacturing purposes in this district, the necessary steam and motive power will be obtained from Mond gas distilled from 10,000,000 tons of coal, thus effecting a considerable economy in the consumption of coal. The gas is to be supplied at the low price of four cents per 1,000 cubic feet.

Two derailments which have occurred recently on the Siberian Railway are a further proof, if any were needed, that the line has been too lightly constructed to enable it to carry the heavy locomotives now running on it, to say nothing of the ever-increasing freight traffic. The first derailment referred to was caused by a "burst rail," and, of course, until the entire line has been relaid with heavier and sounder rails, there will be always the risk of other "burst rails," causing loss of life and interruption of the traffic, says The Engineer. The second accident, which is the fifth of this nature on the new line, shows that the supervision exercised over the traffic is far too weak. The control of the line is in the hands of one man. Both the people and the press of Siberia have come to the conclusion that to insure the proper working of the line in the best interests of the country, the Siberian Railway ought to be divided into three or four separate and independent sections.

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Correspondence.

Photographing in the 50,000th Part of a Second.

To the Editor of the SCIENTIFIC AMERICAN:

In the article appertaining to the history of photography for the past fifty years, published in Sunday's Sun, May 19, 1901, by George G. Rockwood, mention is made of the fact of his having taken photographs in the twenty-four thousandth part of a second, by means of the discharge from a Leyden battery.

As the writer conducted the electrical part of the experiments referred to, and still retains the original apparatus used for the purpose, as well as data relating to the experiments made first at Mr. Rockwood's laboratory, in Union Square, then in the basement of Kurtz's studio—opposite the Post Office at that time—and later at the residence of W. E. Crampton, in Brooklyn, it may add to the history, in a more detailed manner, of this particular line of photography, if the following facts relative to the subject are brought forward.

It was at the suggestion of the late Josiah P. Fitch, a then well-known patent lawyer of New York, that the question as to whether it was possible to have plates made sensitive enough to receive impressions during the minute period of a Leyden battery discharge came up.

Mr. Rockwood was consulted, but, of course, could not guarantee that his plates would respond during the infinitesimal fraction of a second that the Leyden spark gave light.

However, he prepared a number of special plates, and one evening during the summer of 1881 an electro-static machine of French make, giving a spark, under favorable conditions, of eight inches, a battery of fifteen Leyden jars and the necessary mechanical and telephonic apparatus were set up and ready for use about 10 P. M.

A number of scientific men were present, one of whom would be talking in the transmitter, upon the contacts of which the camera was focused, while another would listen at the receiver, in a different apartment, and record the messages articulately received.

Mr. Rockwood figured the duration of the electric spark on the basis of Wheatstone's calculation, that a spark passing through a space of one inch and having the electro-motive force behind of ten Leyden jars would pass in the 24,000th part of a second.

As the electro-motive force of the spark used in these experiments was the product of fifteen jars, connected in series, and the space traversed was from one-quarter to three-eighths of an inch, the duration of the spark, according to the above calculations, was in the vicinity of the 50,000th part of a second instead of the 24,000th.

There was an anxious time spent while Mr. Rockwood was developing the first half dozen plates, as in case of their showing nothing, it would be useless to proceed further in that line of demonstration.

To the surprise, and gratification, of all, the photographs of the transmitter vibrating point came out as clear and distinct as if the exposure had been for a second instead of the 50,000th part of one, and many other fine impressions were taken that evening.

The stationary transmitter contact consisted of a half-inch length of carbon one sixty-fourth of an inch in diameter, and the vibrating one, of a platinum wire of the same dimensions, but tapering to a fine needle point where it contacted with the carbon.

The Leyden spark was discharged at a distance of one inch from the transmitter contacts, on the opposite side of which the camera was focused so as to be in a direct line with them and the center of the space over which the discharge took place.

Some of the photographs were taken with the jars connected in multiple and in multiple-series, but the best results were obtained when all were connected in series. Five of the jars were fractured, through the chains being too short to rest on the inner tin foil.

On examining the fractures with a microscope, they presented a funnel-like formation and had the appearance of being fused, a very surprising fact considering the enormous speed with which the sparks passed through the glass. One of the holes had the appearance of having been made by a bullet.

While the experiments were being conducted the laboratory was in absolute darkness, and the sensations experienced by those present when the discharge took place were of a very peculiar nature, especially when anyone, accidentally, got too close to the Leyden jars. Often, when seemingly safe for handling, a residual charge would assert itself to someone's discomfiture.

Among those present were Josiah P. Fitch, W. E. Crampton and T. A. Richards, M.E.

Subsequently to the above experiments, several nights in Mr. Kurtz's studio resulted in the production of many plates of varying quality.

It was then decided that micro-photography would be necessary for the proper elucidation of the object aimed at, and Mr. Crampton immediately had a room equipped for the purpose in Brooklyn, and went thoroughly into the study of rapid photography.

A very powerful microscope was attached to the camera used, and necessitated the use of very minute contact points on the transmitter, as it had to be brought to within the thickness of a piece of cardboard from the lens, to get the proper focus, and the handling of the apparatus had to be conducted with extreme delicacy and care, through one of the contacts being made from a piece of carbon filament taken from an incandescent lamp and the other from a very fine platinum needle.

The minute contact points were magnified to about one inch in diameter and showed results far ahead of the previous experiments, and seldom were the points caught in actual contact.

By several months' hard work, a beautiful collection of negatives was obtained, showing the contacts at varying positions relative to each other, every negative being taken while articulate speech was being transmitted and received over the telephone.

Those experiments showed visually and conclusively that mechanical contact could be and was broken to a minute extent between the transmitter contacts, while articulate speech was being transmitted, and without impairment of its quality, but, of course, the Bell telephone people argued that it was not by reason of, but in spite of, the mechanical breaks that speech was transmitted, and if the quality of speech was not impaired it was for the reason that, although the circuit might be broken mechanically, it was closed electrically, through the current bridging the gap.

There is little doubt but that Mr. Rockwood is entitled to the credit of making the first photographs by means of a spark from a Leyden battery, and that Mr. Crampton was the first to make micro-photographs by similar means. The same electrical apparatus was used in both cases.

After going the length he did, Mr. Crampton decided to have made the most powerful microscope that could be focused on the transmitter contacts, and use it for the purpose of examining with the eye the actions that took place between them. The microscope was of 4,000 diameters and the contacts had to be flattened to allow of its being brought within range. It was rigidly fastened to the same base as that of the transmitter, but even then, owing to its great magnifying power, the least touch would throw it out of focus, and it required a great deal of perseverance and skill to use it at all.

A minute incandescent lamp was placed behind the contacts, and when speech was being transmitted the vibrations were too rapid for the eye to catch the contacts together, a thin streak of light appearing between them, all the time that speech was being transmitted.

When the incandescent lamp was extinguished a most beautiful halo of bluish, purple light, radiating from the points, was seen. Magnified as it was, it seemed to extend about half an inch around the contacts, melting into the darkness in a very gradual and misty manner, that would seem to confirm the theory of some experts that a luminiferous ether conducted the current when the points were separated. These effects could, of course, not be distinguished with an ordinarily powerful microscope.

J. HARI ROBERTSON.

Brooklyn, N. Y.

The Nernst Arc Light.

Somewhat more than a year ago the Nernst incandescent lamp was brought forward with a filament of refractory, earthy material instead of the usual carbon, and heated in the open air instead of in a vacuum. In the Elektrotechnische Zeitschrift of February 14 an arc lamp with pencils of similar refractory material is described. This new electric arc is similar to the Jablochkoff candle of long ago, in that the arc length from point to point of the electrodes for the case reported is about 0.04 inch and nearly constant. The most important feature reported for this new arc is its comparatively high efficiency. Good incandescent lamps with carbon filaments show an efficiency of 3 watts per mean spherical candle power. Open-arc direct current lamps show an efficiency of about 0.3 watt per candle power in the direction of greatest intensity of light, but this rises to about 0.6 watt per mean spherical candle power. This great variation between mean and maximum candle power is partly due to the shape of the carbon points, which form so as to produce the greatest illumination at an angle of about 45 degrees below the horizontal. The new arc lamp above mentioned is reported to have given a horizontal candle power of 556 units with an expenditure of 154 watts at the arc. This corresponds to a horizontal illumination of 0.27 watt per candle, or about that of present direct current arcs at 45 degrees below the horizontal. While the ordinary arc is maintained between carbon points, one of which is convex and the other concave, this new arc takes place between points of refractory material, both of which are convex. Moreover, the pencils of refractory material for this latter arc are only 2.5 times as great in diameter as is the arc length, while the diameter of carbon points is generally as much as six times the lengths of their arcs. These conditions make it appear that the arc with pencils of refractory material may have a much wider field of maximum illumination than does the direct current arc with carbon points, and consequently that the mean spherical candle power of the new arc may be nearer that at the horizontal or maximum point than is the case with carbons and direct current. With alternating current the mean spherical candle power of the arc between carbons of convex points is about 70 per cent of the maximum intensity. If this relation holds good for the new lamp, its mean horizontal candle power for the case reported should be $556 \times 0.7 = 389.2$ units, and the efficiency $154 \div 389 = 0.4$ watt per mean spherical candle power. Another important feature of the new lamp seems to be its adaptation to moderate rates of watt consumption and candle powers, because of its simplicity. The considerable amount of mechanism incident to the arc of varying length in a lamp with carbon points, and the lower efficiency of very small lamps of this kind, has tended to confine their use to points where large candle powers are desired.

A. D. A.

Automobile News.

Motor carriages are possessed by King Edward VII., by Queen Alexandra, the Czar, the Emperor of Germany, the King of Belgium, the King of Italy and the Shah of Persia. Queen Alexandra uses an electric motor car.

Automobile omnibuses are to be run between Huntington, Northport and Oyster Bay, L. I. They will carry fourteen to eighteen passengers. The steering is done by means of compressed air. Both power and hand brakes are used. The motor is of sixteen horse power.

According to The Automobile Magazine, when a horse has been injured in the steeplechases at Auteuil, France, and is unable to rise, a specially constructed motor car is brought up and the wounded animal deposited in it and transported away to the care of the veterinary surgeon.

A novel type of motor war machine is being built by Vickers, Sons & Maxim, Limited. It is an armored car intended for the protection and inspection of railways. It runs on the rails and is propelled by a petrol motor, the armament consisting of a one-pounder Maxim gun. Each machine is constructed to be manned by one officer and two or three men.

The Fifth Avenue stages of New York city are all to be operated by electricity. The development of the electric omnibus has been long delayed by the difficulty of finding a satisfactory storage battery. The new vehicles which have been ordered will be ready about August 1, and they will be capable of holding thirty-four persons. The top of the old stages were so low that they were uncomfortable for tall persons. This defect has been remedied in the new ones. They will be double-decked affairs and will be equipped with rubber tires.

Observations of the Giacobini Comet—Nice Observatory.

M. Perrotin has communicated to the Académie des Sciences a series of observations made upon the comet discovered by M. Giacobini at the Nice Observatory on the 20th of last December. These observations, which were made at Nice from the 24th of December to the 11th of January, are shown in the table.

APPARENT POSITIONS OF THE COMET.

Date.	Mean Time of Nice.	α	D. P.
December 24 ...	7 h. 38 m. 23 s.	22 h. 57 m. 19.60 s.	112° 42′ 12.3″
December 25....	9 34 59	23 3 22.50	112 49 30.5
December 26....	7 49 38	23 9 28.06	112 55 59 6
January 6... ...	6 36 13	0 13 5.88	113 7 38.2
January 11	6 51 8	0 40 10.40	112 40 53.2

These observations do not as yet advance very much farther the present knowledge of the orbit, whose parabolic elements were at first calculated by Messrs. Kreutz and Möller, of the Kiel Observatory, and later by Mr. Campbell, of Mt. Hamilton, but since the recent atmospheric troubles the heavens have again become clear, and the observations will be taken up again with the hope of making new calculations. This comet is likely to be of especial interest, owing to its direct movement and the value of certain of its elements, which make it resemble a singular type of comets whose number is continually increasing. M. Perrotin thinks that we shall soon be edified upon this point if the new body, whose brilliancy is decreasing, may be followed long enough to permit the determination of elements having for base an arc of some extent. The tail of the comet extends at an angle of position near 45 degrees, and measures from 2 to 3 minutes of arc in length; the nebulosity of the head, which is regularly rounded, surrounds a well-characterized nucleus of about the 11th magnitude.

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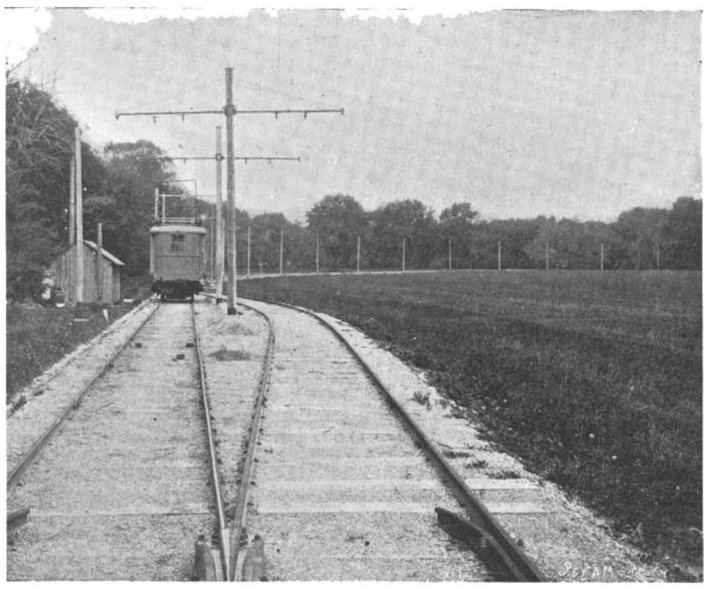
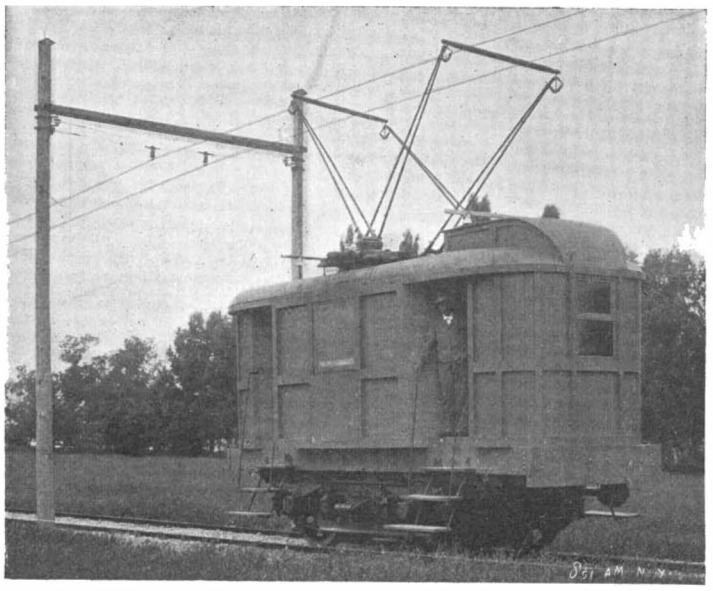
THE GANZ ELECTRIC LINE OF VALTELLINA.

In a very short time the electric line of Valtellina built by Messrs. Ganz & Co., of Budapest, will be opened to the public. The line has attracted no little attention among European electrical engineers, for the reason that it represents the very highest development of the Ganz three-phase high-tension system of electric traction.



THE GANZ EXPERIMENTAL ROAD ON ALTOFEN ISLAND, NEAR BUDAPEST.

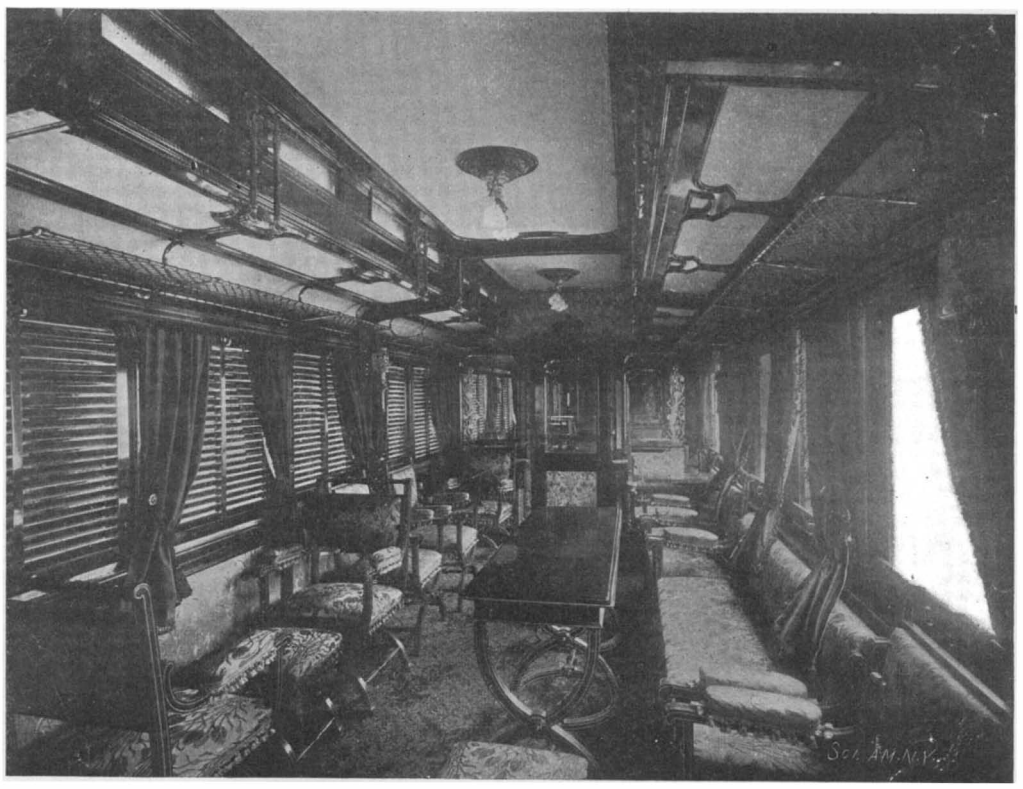


DUMMY CAR OF THE GANZ EXPERIMENTAL ROAD.

The Valtellina line is some 60 kilometers, or 38 miles in extent. Starting from Milan, it runs to Lecco, at the south-east corner of Lake Como, extends along the eastern shore to Colico, at the north end, and then branches off to Chiavenna on the north and to Sondrio on the east. The high-tension lines deliver the primary current of 20,000 volts to nine stationary transformers, which feed the current to the trolley wires and earth rail as three-phase current at 3,000 volts. The efficiency of transmission from the dynamo to the transformers averages 95 at full, 94 at the half, and 94 per cent at quarter load. Current is generated at a central station situated at Morbegno, between the Colico-Sondrio branch. Hydraulic power is used to develop electrical energy. Three turbines, each of 2,000 horse power, are directly coupled with three-phase generators, which supply the primary current of 20,000 volts.

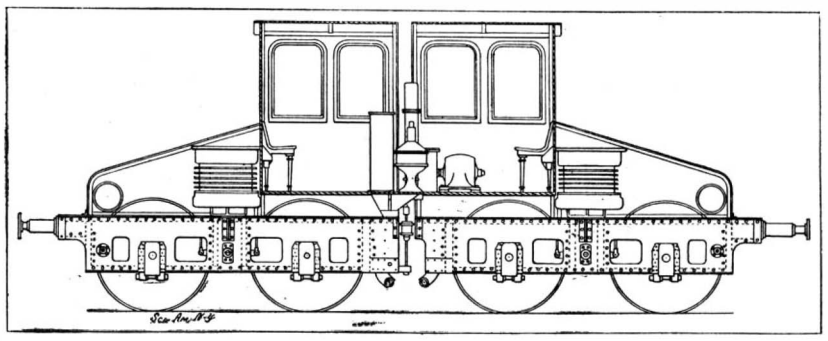
For the line at Lake Como the motor cars are 18.1 meters in the carriage body and 19 meters (62¼ feet) over the buffers. The cars rest on two bogie-trucks, each truck having a wheel-base of 2½ meters. Without passengers a car weighs 50 tons, including the motors. The wheels are 1.17 meters in diameter, while those of the electric freight locomotives supplied to the same line have a diameter of 1.4 meters. The locomotive motor weighs 3.8 tons; its rotor about 1½ tons. The car-motors with a smaller size wheel weigh 3½ tons approximately. Each cascade pair of these motors develops a full-load horse power of 150, while the high tension motor itself, when running at full speed with the low tension motor cut out, yields about the same horse power. Thus, 300 horse power are developed in one truck carrying two pairs of motors, or 600 horse power (450 kilowatts) on one train with front and rear driving cars.

The current generated at the central station has a frequency of 15 per second. When running synchronously the high tension motors make 300 revolutions per minute. In the rotor of the same motor the periodicity of the induced currents varies according to the slip. During the start, when the high tension is switched into cascade connection with the low tension motor, after the speed has risen to "half speed," or 150 revolutions per minute—above which speed the cascade connection ceases—the periodicity of the currents in the rotor of the high tension and in the stator of the low tension is about 7½ per second. The speed of the locomotive motors is 125 revolutions per minute. The Valtellina locomotive motors are not geared in cascade; they are all high tension.



INTERIOR OF CAR ON GANZ VALTELLINA ROAD.

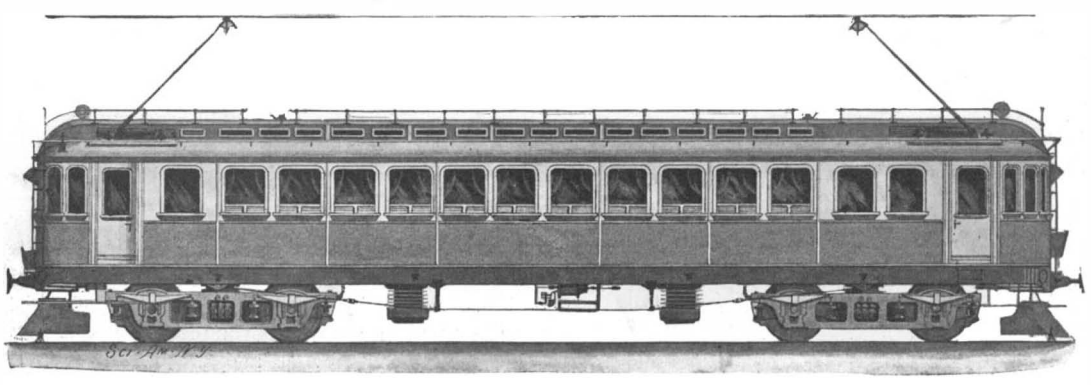
The line will be used for the transportation of both passengers and freight. Passengers will be carried by the cars at a speed of 60 kilometers (37½ miles) per hour. The electric locomotives will be used for hauling freight trains. Each train will have a net weight of 250 to 300 tons. The speed to be attained will be about 30 kilometers (18½ miles) per hour.



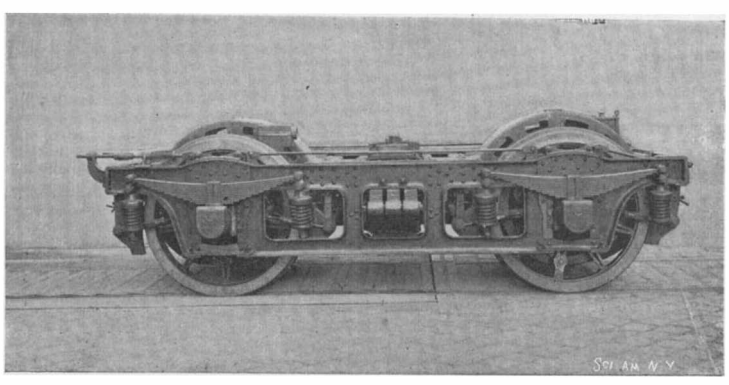
ELECTRIC FREIGHT LOCOMOTIVE FOR THE VALTELLINA ROAD.

The commercial merits of the system are many. The initial outlay is not inordinate. The annual cost of maintenance is said to be comparatively small. For railways of considerable length and heavy traffic, less maximum power is required in the central station with the Ganz high tension distribution than with the necessarily low tension of continuous current distribution, the ratio of maximum to average load at the central station being less.

The electrical merits of the system are no less noteworthy, especially when the length of transmission from one central station is considered. By reason of the high voltage no large currents are used. The loss involved in converting to continuous current by rotary converters is eliminated. The use of pure induction motors without commutators, and the coupling of these in cascade pairs, results in a high motor efficiency.



GANZ ELECTRIC CAR FOR THE VALTELLINA ROAD.



TRUCK OF A VALTELLINA CAR.

Our Mineral Resources.

A chart published by the Geological Survey gives a summary of the mineral products of the United States for the past ten years, says Bradstreet's. The aggregate values have increased by more than one-half in that period, and the figures for 1899 are greater than in any previous year, footing up the enormous total of $976,000,000. The value of the metallic products of the year is given at $527,218,084 and of the non-metallic at $447,790,862. The latter class includes, of course, the coals—$168,000,000 in bituminous and $88,000,000 in Pennsylvania anthracite—$64,600,000 in petroleum, $20,000,000 worth of natural gas and large value in stone, brick clay and cement, with various other minerals. Of the metals, our pig iron is worth almost as much as all others together, the value of the product in 1899 being given at $245,000,000. Copper comes next with $104,000,000, and the $71,000,000 in gold is third. The market value of the silver produced in 1899 was about $33,000,000 and the lead and zinc together were worth about as much. Quicksilver, aluminium, antimony, nickel and platinum are the other metals that figure in the table.

Applied on a burn, where the skin is not yet open, turpentine quickly alleviates the pain.

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METHOD OF UTILIZING OLD STREET CARS.

It was reserved for some original genius in San Francisco to discover a method for the utilization of ancient and out-of-date street cars. There was once a limited demand for these articles from young and ambitious communities that wanted to inaugurate a street railway system of their own and were willing to buy rolling stock, even second-hand, provided the cost was low enough, but the change in the metropolitan systems, first from horse or mule power to cable roads, and afterward to the employment of electricity as the motive power, together with a general demand from the public for improved cars, left so large a number of the old-fashioned kind on hand that the companies were at a loss what use to make of them. To break them up into firewood seemed to be the only disposition possible. The supply was infinitely greater than the demand.

An Italian immigrant in San Francisco solved the problem. He had purchased a lot of land, but had no money left with which to build a dwelling. Observing several of the old cars in store he bought one for $10 and had it transported to his land, where, at small cost, he built a small addition to it and provided a very comfortable home for the family. This example was followed by others, and in various parts of San Francisco there may be found discarded street cars doing duty as dwellings, barns, wood and outhouses that are not only substantial, but at the same time economical and highly picturesque.

There is a little settlement just outside the city where the large majority of the structures were once street cars. It is located at the ocean beach on the shore end of Golden Gate park. What community of interest prompted the beginning of this unique settlement is not known. The fact that the lands are of small value and not likely to be acquired for public uses in many years probably had its influence, though the situation, close to the resounding ocean and bordering upon a largely frequented boulevard, had attractions for many. There are perhaps fifty of these car dwellings in the little settlement, many of them fitted out with considerable elegance and numerous conveniences. They are arranged upon a general plan affording their occupants the widest views, all fronting the sea. Streets intersect, at right angles, and plank walks are laid so as to give pedestrians access to their homes without wading through the deep sands. Few of these cars have been adorned with a coat of paint. The exteriors are generally intact, and the conspicuous signs denoting the route over which the cars once perambulated are not obliterated.

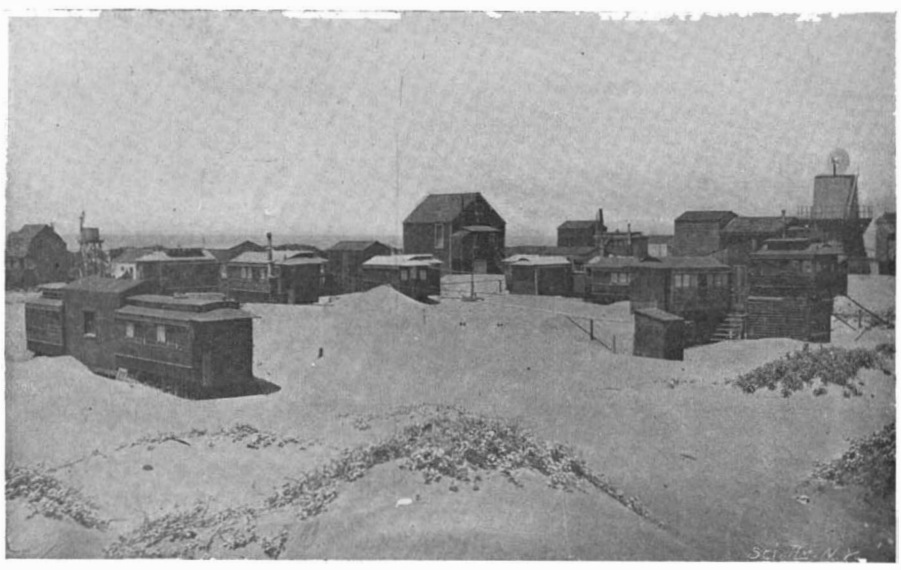
Some methods are used in the adornment of these curious resorts. Many of them are covered with vines, most have galleries extending around the front and sides. The roofs of some are arranged as lookouts, and awnings drop over the windows. There is considerable space for storage below the cars, while other cars acquire additional room by little extensions. In some instances one car is raised above another, and sometimes the cars are laid upon other buildings, thus giving an extra story. The platforms of the cars are often transformed into balconies and bay windows with the aid of the carpenter and glass fitter, and afford points of observation protected from the cold winds, besides giving extended views of sea and land.

The arrangement of the interiors of these dwellings is highly ingenious, the necessities of the case requiring the utmost economy of space, the average sleeping car suggesting a model. Half a dozen persons have been at night accommodated with lodgings in one of them. Ventilation is always assured.

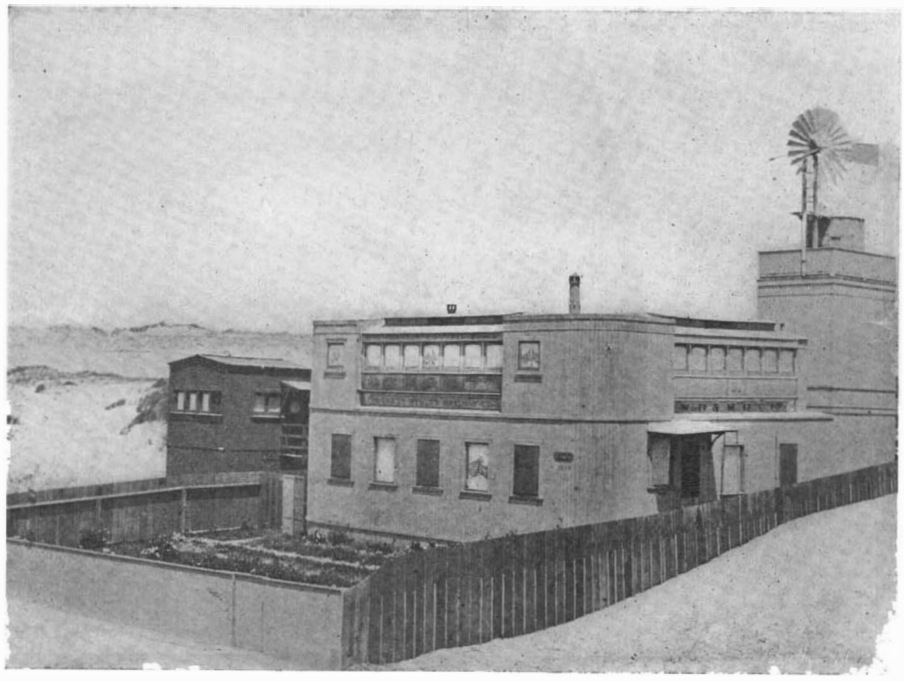
While there are many families permanent residents of "Cartown," the larger number occupy the "vehicles" as others do the house-boat, giving opportunities for original methods of entertainment and diversion for themselves and friends. Confined and restricted as these dwellings are, there is compensation in the fresh ocean breeezes which here blow right from the sea, besides the enjoyment of a health-giving environment. History and romance have been ransacked in providing names for these car "villas" suitable to the facetious idiosyncrasies of their various owners. In "Cartown" the "Villa Miramar" and "Château Navarre" adjoin the modest restaurant and more conspicuous bar.

There are many kinds of trades pursued in this odd settlement, restaurants and bars being most numerous. "Cartown" is an interesting spot for the visitor, not only on account of its individual attractions, but as a demonstration of the problem of what can be done with street cars that have outlived their usefulness.

A "Cartown" Home.



"Cartown," San Francisco.



A "Cartown" Skyscraper.

Interior of a Car Home.

CURIOUS VILLAGE IN CALIFORNIA, BUILT OF OBSOLETE STREET CARS.

Electric Motors for Street Cars.

Three methods of supply for motors driving electric street cars are now in vogue, two being practised in the United States, while the third is found in Europe. The most common arrangement includes direct current generators at the main station, operating at 500 to 600 volts, distribution lines leading from these generators to the trolley lines, and direct current car motors. Another plan, of which an example is found in New York city, provides only alternating generators of comparatively high voltages, as 6,500 or more, at the main station, lines that connect these generators with transformers at sub-stations, rotary converters fed from these transformers and developing direct current at 500 to 600 volts, and lines that distribute this last current to the trolley and direct car motors. The third system, examples of which can be found by crossing the Atlantic, avoids the use of sub-stations and their rotary converters, and connects high tension alternating generators at the main station to transformers on the moving cars, by means of the necessary lines and trolleys. On the electric cars the transformers reduce the high line pressures to those suitable for alternating three-phase motors, which are used to supply the required power. This last system has the obvious advantage that it avoids the expense of sub-stations, rotary converters, and 500-volt distribution lines incident to the second system named. To offset this advantage, the three-phase motor is not yet as desirable in efficiency and regulation as its direct current competitor. The alternating, long distance and the direct current short distance systems may both remain, but it seems doubtful whether the mixed system with rotary converters finds permanent place.

Naphtha launches under ordinary circumstances are perfectly safe, but with any form of liquid fuel a certain amount of care must be exercised. An explosion recently occurred at Great Neck, L. I., which was caused by lighting a match near the naphtha tank. Immediately there was a tremendous explosion. The burning naphtha was scattered in every direction, setting fire to the launch and to the clothing of the owner and his wife, who immediately jumped into the water.

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Hardness of Metals.

F. Auerbach's definition of hardness is given for the case of plastic bodies, including metals, by the limiting pressure per unit surface, attainable between a lens and a plate of the same substance, says Science Abstracts. In the case of metals the deformation cannot be observed with the same facility as in the case of transparent bodies, but the surface of contact may be measured by covering the lens with a thin layer of lampblack. This is only necessary at small pressures, since at great pressures the deformed area retains its shape. A complication is introduced by the fact that the hardness is considerably influenced by small impurities, as well as by the elastic and thermal history of the metal. The author gives the following table of the hardness of various fairly well-defined metals, as compared with minerals:

Steel	361	Quartz.
Copper (hard)	143	Apatite.
Bronze	127	
Brass	107	Fluorspar.
Gold	97	Calcspar.
Copper	95	
Silver	91	
Aluminium	52	Boracic Acid.
Lead	10	Gypsum.

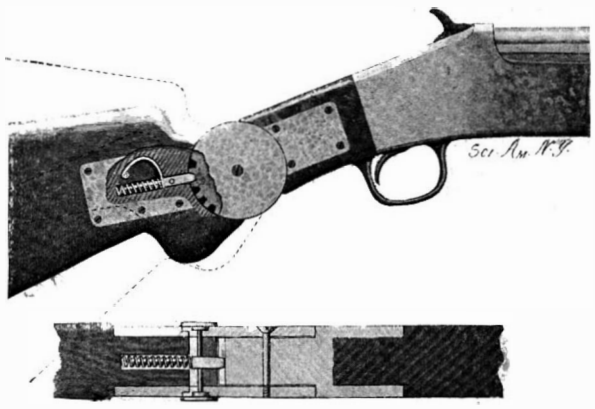
The aluminium was alloyed with 6 per cent copper. The bronze was an alloy of 15 parts copper, 2 parts zinc, and 1.5 tin. The brass contained 2 parts copper to 1 of zinc.

Shipping at Nagasaki.

Consul Harris, of Nagasaki, February 9, 1901, reports the launching, on the 26th ultimo, of the steamship "Kaga Maru" from the Mitsu Bishi Dock Yard and Engine Works, of that city. This vessel was constructed under the shipbuilding encouragement act of the Japanese Government and Lloyd's rules, class 100, A1, and was built to the order of the Nippon Yusen Kaisha (Japan Mail Steamship Company) for its American line. The materials used in its construction were purchased in England, and the keel was laid on the 20th of March, 1900. The ship is to be completed and delivered in March, 1902. A description follows: Type, 3 decks; material, steel; length over all, 459 feet; beam, 49 feet 2 inches; depth, 33 feet 6 inches; gross tonnage, 6,240 tons; displacement, 11,800 tons; draft, 25 feet; dead-weight capacity, 6,820 tons; engines, twin-screw, triple-expansion; boilers, cylindrical, four in number; indicated horse power (estimated), 4,500; speed, 15 knots.

THREE RECENTLY PATENTED NOVELTIES.

Three interesting inventions which have been patented in the United States within the last few months are an adjustable gun-stock, a combined rocking-chair and cradle, and a single-wheel vehicle.



AN ADJUSTABLE GUN-STOCK.

The gun-stock is the invention of Mr. Joseph N. Zoeller, a resident of St. Matthews, Ky. Within the stock an adjusting-head is pivoted and attached to the grip. The head is provided with peripheral teeth, between the spaces of which a bolt, held in the stock, may enter. A manipulating device is provided for the bolt, which device is passed to the outside of the stock for convenient operation. To change the inclination of the stock, the bolt is carried out of engagement with the adjusting-head. After the grip has been moved the bolt is allowed to enter the most convenient space between the teeth to hold the stock and grip as adjusted.

Samuel S. Arnold, of Toronto, Canada, is the inventor of the combined rocking-chair and cradle. The upper and lower bars connecting the rockers of the chair are grooved to receive the corresponding bars of a cradle provided with a rocker at one end. Pins limit the movement of the cradle. When not in use the cradle can be pushed under the chair.

Perhaps the most curious invention is Mitchell R. Heatherly's single-wheel vehicle. Our illustration shows the construction so plainly that an extended description is hardly necessary. Broadly, the contrivance consists of a curved tongue pivoted to the harness, and a single wheel carried by the lower end of the tongue. Above the axle of the wheel are stirrups for the rider or driver, if we prefer to call him so. Suitable handles are provided on the tongue, which are to be grasped for security. The tongue, it should be observed, is so connected with the harness that it will adapt itself to the motion of the horse. Mr. Heatherly lives in Mundell, Kans. His vehicle is designed to take the place of the bicycle and to be used on race courses.

The Development of Wireless Telegraphy in England—Its Proposed Adoption in the Post Office.

Some months ago, when the utility and widespread advantages of Marconi's invention were conclusively established, a Departmental Commission of the English Post Office was formed to consider the merits of the system and the advisability of its adoption throughout the British postal service. The report of this

COMBINED ROCKING-CHAIR AND CRADLE.

commission is now complete, and it is stated to relate favorably upon the scheme in its general principle.

The result of this commission consequently portends a great revolution of the English telegraphic service. For several months past the telegraph authorities have been endeavoring to satisfactorily cope with the exigencies of the rapidly increasing telegraph traffic, but the country is so comparatively small, and the congestion of the traffic so acute, that practically no headway has been made toward the solution of the difficulty. If Marconi's system were employed the possibility of blocks on the lines would be entirely obviated, since each telegraph office would have its own synchronized receiver, and only the transmitter corresponding with that receiver would be able to establish communication therewith. Then, again, in stormy weather widespread damage is caused to the wires, frequently destroying communication, while in connection with Marconi's system it has been proved to work better in boisterous weather. These salient characteristics have impressed the commission, and have no doubt appreciably influenced their favorable decision.

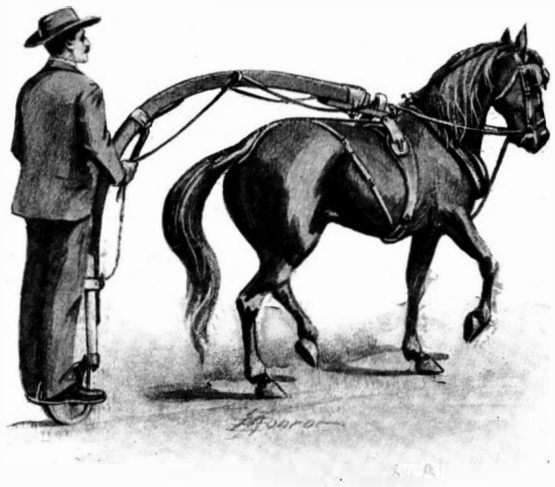
Yet the scheme will have to be well prepared, since its innovation is attended with numerous difficulties, some of which can only be obviated by Parliamentary measures. For instance, the British Post Office has a monopoly in any system of telegraphy, and it is only natural to expect that they will endavor to enforce these rights in the present case. In this event Marconi will be prevented from establishing independent installations without the official license. It is generally believed that at the present time the Post Office does actually claim the monopoly of wireless telegraphy in the British Isles, and that Marconi has not yet received the necessary license to install his system. This belief is somewhat supported by the fact that the English government will not permit wireless telegraph communications to be transmitted from a point less than three miles from the shore. This fact was established at the inauguration of the system upon the mail packet service between Dover and Ostend, when the authorities would not permit the establishment of a land station at Dover. The Post Office is awarded this monopoly by act of Parliament, and it is practically certain that if necessary they will enforce that prerogative. But such a contingency is hardly likely to arise. Marconi has placed himself at the disposal of the commission and has extended them every assistance in his power, in order that the advantages of the system might be thoroughly understood. That the system will be nationalized there is not the slightest doubt, as in the cases of the telephone and the District Messenger Agency of London.

For once England is desirous of leading the way. Negotiations have already been opened with one or two of the European powers, concerning the idea of establishing the system partially, if not entirely, upon the Continent. By this means the cables will be dispensed with, and the international messages transmitted through the air. Of course there is the question of expense, because such a radical revolution could not be effected except with a great outlay. Yet the system is cheap to install, for the cost is limited to the purchase of transmitters and receivers. Wires, poles, and cables are entirely dispensed with. It will even be unnecessary to erect the lofty pole in connection with the apparatus, since Marconi has invented a cylindrical appliance which performs the same functions with equal satisfaction, as described in a recent issue of the SCIENTIFIC AMERICAN.

Another instance of England's desire to encourage the utilization of the system is proved by the decision of the Admiralty to equip all the vessels in the fleet with the apparatus. Several ships are already supplied, but those which are yet deficient in this respect are being fitted with all possible speed. In a few weeks' time the report of the commission will probably be published, together with the suggestions for acquiring the system from Marconi without interfering with the legality of his patents. Certainly the action of the British authorities will be followed with keen interest by the other nations, and should Great Britain decide upon its immediate introduction other nations will be compelled to do likewise.

Demand for Blood-Oranges in Germany.

Consul Hughes writes from Coburg, April 26, 1901, as follows: There is a great demand in Germany for the so-called "Italian blood-orange." The popular idea here is that this fruit is colored, not by nature, but by injections of some artificial vegetable dye. To discover the truth or fallacy of this belief, several well-known German chemists have been experimenting, first, to find out from the blood-orange itself if its color is due to artificial means, and, secondly, to change the common Italian orange into a blood-orange by injections of different kinds of coloring matter. The experiments, however, have not been attended with success. It was found that no single injection of any solution would color more than one part of the orange, and that if several injections were made, the fruit was likely to decompose very quickly. The theory was then advanced that the coloring was produced by watering the roots of the trees with a blood-red vegetable solution. It is needless to say this experiment was as barren of results as the first.



A CURIOUS VEHICLE.

The Current Supplement.

The current SUPPLEMENT No. 1330 has many articles of general interest. The Racing Yacht "Independence" is accompanied by two illustrations, showing the bow and the remarkable rudder. "Protection of Ferric Structures," by M. P. Wood, is a continuation of a most important paper. "Resistance to Death Among Insects" is a most curious natural history article. "Recently Discovered Greek Masterpieces" is accompanied by a number of engravings made from photographs showing the remarkable nature of the find. "Packing Goods for Foreign Markets," which was commenced in SUPPLEMENT No. 1329, is concluded in this issue and shows how goods of all kinds should be packed for export.

Contents.

(Illustrated articles are marked with an asterisk.)

Automobile news	407	Heavens in July	403
Automobile race, speed in	402	Light, arc, Nernst	407
Biggest in the world	402	Mail-box, house*	404
Books, new	411	Metals, hardness of	410
Butter-packing	404	Mineral resources	408
Cars, utilizing railroad*	409	Nagasaki, shipping at	410
Chair and Cradle, rocking*	410	Paper, fire from waste	406
Chicago, water supply of*	405	Photographic printing	404
Clarke, T. C	403	Photography, quick	407
Comet, Giacobini	407	Provisioning a transatlantic liner*	401-406
Como, electric line*	408	Spigot, self-closing*	404
Cruisers, reconstruction of German	402	Steamships, coastwise	402
Docking accident*	404	Street car, motors for*	409
Ferryboat disaster	402	Vehicle, curious*	410
Gun stock*	410	Wireless telegraphy in England	410

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

SWITCH FOR ELECTRIC LAMPS.—CHARLES WAGNER, Manhattan, New York city. The switch is arranged to permit one conveniently to turn the current on or off. The appearance of the lamp is improved, especially when the device is applied to the candle-type of lamp. The unsightly key heretofore used in electrical switches is dispensed with, and a sleeve employed for opening and closing the switch.

ELECTRIC-CLOCK SIGNAL.—HARRY B. VAUGHAN, Little Rock, Ark. The signal-clock is of that form in which the clock-hands are made to touch contact-points on the face of the dial, and, by closing an electric circuit at any particular point or hour or number of points, to ring at that hour any particular bell or number of bells. The present invention consists in the peculiar arrangement of such devices whereby any number of guests in a hotel can be automatically called at any particular hour, and whereby all the guests of the hotel are alarmed in case of fire. An alarm-signal can be sounded in any one of the rooms, and an electric lamp lighted by one automatic mechanism.

Mechanical Devices.

PUNCHING-MACHINE.—GEORGE M. ROGERS, Manhattan, New York city. The machine is designed to indicate upon a dial the force of a blow struck upon a pad. The blow has no direct influence on the indicator-hand, but merely deflects an intermediate lever to a greater or less degree, according to the force of the blow, to which position it is held by a locking device. The lever acts as a stop-device to determine the drop of a rod which operates the indicator-hand.

SAFETY-CATCH FOR ELEVATORS.—HENRY JEWELL, Butte Mont. The safety-catch is to be applied to the lower deck of a car and to be operated from the king-bolt to which the hoisting-cable is applied. While the hoisting-cable is in good condition and supports the car, the catches are inactive. But as soon as the cable breaks, the catches are automatically forced beyond opposite sides of the car into engagement with the wall of the shaft, or with racks or their like.

LOCK.—IRA W. ABBOTT, Nevada City, Cal. The novel feature of this padlock is a slide unlocked and moved by a key and adapted to engage a spring-pressed knee-joint bolt. This bolt is pivoted and designed to engage with its free end the shackle of the bolt. The lock cannot be picked unless the person has the proper key. The lock is simple and durable and can be cheaply manufactured.

HYDRAULIC AIR-COMPRESSOR.—LEE E. MITCHELL, Boston, Mass. Mr. Mitchell has improved the air-compressor which he invented in 1900. In the power-cylinder a piston reciprocates. Valve-chests open into the cylinder at the ends and have waste-outlets. A supply connection is provided between the valve-chests. A reciprocating-valve is arranged alternately to open and close the connection to the valve-chests and alternately to close and open the discharge for the waste-outlets from the valve-chests. The piston-valve is actuated by a shaft mounted to rock and provided with a lug. On the shaft a crank-arm is mounted loosely and connected with the valve-stem of the piston-valve, the crank-arm having spaced shoulders adapted to be engaged alternately by the lug on the shaft. The shaft is rocked from the piston-rod of the power-cylinder.

Railway Appliances.

PNEUMATIC PACKAGE-HANDLER.—GEORGE H. WALL, Cadillac, Mich. This package-handler consists of an air-cylinder located at each side of the car-doorway, the pistons being attached to a section of the car-floor. The arrangement provides a platform about five feet long and having a width equal to that of the car-door. A governor maintains the level of the platform during operation. Air is drawn from the train-line into a special reservoir for the operation of the device. A forty-day test was given to the first machine to show that air from the train-line could be used for the purpose of loading and unloading baggage. The inventor is an old and experienced railroad man.

CAR-COUPLER.—MARK A. BROWN, Douglas, Ga. The coupling belongs to that class in which the drawhead is provided with a pivoted member or knuckle adapted to be locked after engagement with a similar knuckle on another car. In the present invention provision is made to allow a yielding lateral movement of the locking-pin.

Miscellaneous Inventions.

DRAPERY-HANGER.—JOSEPH LANGLOIS, Leominster, Mass. The invention is a drapery-hanger designed to be erected in houses to form an enclosure for coffins. The essential feature is a brace or truss for the side-bars of the drapery-hanger, the brace having a crotch or fork between its ends and a hook at each end. The crotch engages the side-bar and its ends with the hooks, which are adapted to pass around the bar.

WICK-TRIMMER.—ROBERT M. JOHNSON, Lancaster, Penn. This simple device serves to clamp a wick to be trimmed. By its means, the wick is compressed at its exposed or igniting surface; moreover, a straight horizontal line is established at the charred portion and a substantial surface is obtained at each side. Upon these surfaces the shears or scissors may bear, and over the surfaces the wiping material may be drawn.

RETURN-FLOW SYRINGE.—DENWOOD N. L. NEWBURY, Manhattan, New York city. The syringe consists of a tube having apertures in its sides, and a shield within which the tube is contained. This shield comprises a body section having a series of curved bars, and a front section in the form of a loop with which the outer ends of the bars are joined. The inner ends of the bars are connected with a perforated cap-plate. The outer end of the tube extends out through the loop-section; and the inner end of the tube screws into a collar connected with the apertured cap-plate. A receptacle is carried by the lower portion of the loop-section.

HAT-BOX.—BENJAMIN F. PORTER, Manhattan, New York city. The hat-box is so constructed that the hat can be raised at the bottom of the box, lifted to the top, and held in its raised position without injury. Thus the hat can be brought into position for inspection or for careful removal.

PIANOFORTE.—HERBERT S., PERCY A., and OWEN E. READING, 18 Albion Road, Tunbridge Wells, England. The invention relates to improvements in pianofortes in which a sound-board formed of a rolled or cast-plate or sheet of aluminium or aluminium alloy is employed, in order that the instrument may withstand the effects of a hot, damp climate so prejudicial to the ordinary wooden sound-board. Moreover, the resonance is increased; a longer sustaining power is obtained; and the quality of the tone is improved.

JEWEL-HOLDER AND FASTENING DEVICE FOR CORD COLLARS.—SHERWOOD B. ROBERTSON, Brooklyn, New York city. The device is intended to be used with cord collars worn by Masonic fraternities. The invention provides a neat and efficient means of holding the ends of a collar, at the same time allowing the ready attachment of ornaments or jewels and presenting an outer surface suitable for the production of emblems or other ornaments.

SAW-GAGE.—DANIEL C. STEELE, Village Mills, Texas. Mr. Steele has devised an improved saw-gage more especially designed for use on saws having cleaner-teeth and arranged to permit accurate filing of the cleaner-teeth without leaving an undesirable burr and without danger of filing the teeth too short for proper working in a cut.

WELL-DRILLING APPARATUS.—MILTON LATTA, Burwell, Neb. The apparatus is light and readily portable. It can be operated by hand, thus avoiding the necessity of horse-power. The pump-valve is not subjected to the action of the mud, dirt and gravel drawn up through the well-tube. The receiving chamber is closed by a construction which can be readily removed for the purpose of cleaning it out. The current through the drill is fast and strong enough to draw up gravel. All work is performed on the ground surface. The strain or suction is always inward, so that in case of breakage or a leak at any point the mud, water, and the like will not be thrown outward upon the operator.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

NEW LANDS. Their Resources and Prospective Advantages. By Hugh Robert Mill. London: Charles Griffin & Company, Limited. Philadelphia: J. B. Lippincott Company. 1900. With ten maps. Pp. 280.

The present volume deals with a subject which is of great interest, in view of the present tendency for persons to leave the old countries and emigrate to new lands. The book presents, in a simple and practical manner, the conditions of life in those parts of the world where there is still an opening for the energies of the English-speaking people desiring to make their home or invest their capital in a new country. Little more than the countries of the temperate zone are considered. The author has done his work thoroughly, and it is a book which cannot but prove of value to the audience to which it is addressed.

WATER POWER. An Outline of the Development and Application of the Energy of Flowing Water. By Joseph P. Frizell. First edition, first thousand. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1901. Pp. 563. Price, $5.

Water power is becoming more and more prominent every day. Recent remarkable developments in electricity and other modes of transmitting mechanical energy have recalled water power to something like its former position in the industrial economy of the world. The changed conditions have given a new interest to this source of power, and directed the attention of investors to sources which formerly appeared entirely outside the range of practical consideration. They have also led to some noteworthy improvements in the utilization, development and transmission of power. The author has done a real service to civil and hydraulic engineering by writing an admirable book outlining the latest practice. The book has many illustrations, and is well printed and bound.

THE PRINCIPLES, CONSTRUCTION, AND APPLICATION OF PUMPING MACHINERY. By Henry Davey. London: Charles Griffin & Company, Limited. Philadelphia: J. B. Lippincott Company. 1900. With frontispiece, five plates and over 250 illustrations. Pp. 295. Price, $6.

The purpose of this book is to present the information in such a form as will make it most useful to the practical engineer engaged in the application of pumping machinery in mines or elsewhere, or in circumstances under which large quantities of water have to be dealt with. A large number of illustrations are given, showing the typical installations, and there are several full page and folding plates. The practice appears to be largely English practice, but it is certainly of very late types. It is a book which will be indispensable to the hydraulic engineer.

SUR LES NERFS CEPHALIQUES, LES CORPORA ALLATA ET LE TENTORIUM DE LA FOURMI. Par Charles Janet.

ESSAI SUR LA CONSTITUTION MORPHOLOGIQUE DE LA TETE DE L'INSECTE. Par Charles Janet. Paris: Georges Carré et G. Naud. 1899. Pp. 74.

L'ESTHETIQUE DANS LES SCIENCES DE LA NATURE. Par Charles Janet. Extrait du Bulletin de la Société Zoologique de France Reconnue d'Utilité Publique, Année 1900. Paris: Au Siège de la Société Zoologique de France. 1900. Pp. 8.

ENGINEERING CHEMISTRY. A Manual of Quantitative Chemical Analysis for the Use of Students, Chemists, and Engineers. Second Edition. By Thomas B. Stillman, M.Sc., Ph.D. Easton, Pa.: The Chemical Publishing Company. 1900. Pp. 503. With 132 illustrations.

This book was written especially as a manual of quantitative chemical analysis for the use of students, chemists, and engineers. It treats especially of the determination of impurities in the various metals, water for all uses, and various other commercial substances such as paper, lubricating and illuminating oils, paint, cement, and the like. There are also chapters on liquid fuel, petroleum, and asphalt. A classification of the different grades of steel and their uses forms one of the most valuable chapters of the book. There is also an interesting chapter on pyrometry. The book concludes with chapters on the electrical units and energy equivalents, which are especially useful for ready reference. Numerous tables of pressures, temperatures, percentages, etc., are also appended.

NEW IDEAS. Quarterly Publication of the Romanes Society. Published by Witherby & Company, Office of Knowledge, 326 High Holborn, London.

We have received the January and March numbers of this pamphlet, which contain Essays Toward a Mechanical Theory of Vital Processes. The Romanes Society was founded at Christchurch, Oxford, in 1897, for the purpose of stimulating and promulgating original thought and research in science; and in New Ideas are printed original articles of merit on scientific subjects.

THE CHEMICAL ANALYSIS OF IRON. By Andrew A. Blair. Philadelphia and London: J. B. Lippincott Company. 1901. 320 pp., 105 figures. Price $4.

This work is intended as a guide for the student of iron chemistry. In it are described many special apparatus for the performance of analytical work which otherwise only the possessor of a complete chemical library would have at his command. The book has just entered its fourth edition, and has been entirely rewritten and brought up to date. Besides apparatus for analyzing iron and steel, the author treats of the analysis of slag, clay, sand, coal, coke, and furnace and producer gases also. The book will be found of great value to chemists engaged in this special line of work.

WATERWORKS DISTRIBUTION. By J. A. McPherson, A.M., C.E. New York: The D. Van Nostrand Company. 1901. 154 pp., 19 full-page diagrams and 103 other illustrations. Price $2.50.

This book is intended as a short, practical guide to the laying out of systems of distributing mains for the supply of water to towns and cities. It is by a practical engineer who has had twenty-four years' experience; and contains much valuable data, together with numerous illustrations of the various valves and other apparatus employed in an up-to-date supply system. A large chart of an example district, showing distribution, is added to the other diagrams.

We acknowledge the receipt from the Director of the Sydney Observatory of New South Wales, Australia, of a report on the Results of Meteorological Operations in New South Wales during 1898, which is used in the Department of Public Instruction on Meteorology of New South Wales. It is very complete in its arrangement of items of special interest.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 904.—For manufacturers of spring motor fans.

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 905.—For parties to manufacture a money bag of canvas and brass.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 906.—For the manufacturers of the James Sash Lock.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 907.—For manufacturers of water wheels or any form of hydraulic power.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 908.—For parties engaged in cutting out sheet metal letters in tin or brass.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 909.—For manufacturers of small spur gear wheels and sprocket wheels.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 910.—For the address of the toy gas engines "Paradon" and "Weedens."

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 911.—For parties to manufacture an article composed of small glass tubing and of special dimensions.

Sheet Metal Stamping: difficult forms a specialty. The Crosby Company, Buffalo, N. Y.

Inquiry No. 912.—For manufacturers of miner's novelties, also for the address of a newsdealer to supply quantities of newspapers, magazines, etc.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 913.—For manufacturers of air blowers or injectors, fuel oil injectors, air and oil injectors, operated by steam or compressed air.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 914.—For manufacturers of drill presses, electrical tools, boilers, engines, dynamos, motors, laundry machinery, etc.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 915.—For manufacturers of automatic piano-playing devices.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 916.—For manufacturers of wheels for wheel barrows.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 917.—For parties to furnish oval rosewood handles by the gross, for harness makers' round knives.

Wanted—Punch and Die Work, Press Work and light Manuf'g. Daugherty Novelty Works, Kittanning, Pa.

Inquiry No. 918.—For manufacturers of small gasoline motor castings of ¼ or ½ horse power.

Manufacturers of Valves, Fittings, Brass and Iron Work. Spindler & Deringer, 18-22 Morris St., Jersey City, N. J.

Inquiry No. 919.—For manufacturers of castings for small model steam engines, also of supplies for small boilers.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 920.—For manufacturers of screw wrenches, etc.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 921.—For manufacturers of pine pails and barrels for salt fish.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 922.—For manufacturers of automobiles (gasoline system) to carry 2 persons up a grade of 15 per cent over country roads. A twin cylinder machine preferred.

Will give a one-half interest in twelve inventions, or any part of number, for money to perfect patent and dispose of same. Address S. O. Stewart, E. Las Vegas, New Mexico.

Inquiry No. 923.—For a half mile of second-hand rails to hold cars loaded with five tons of lumber.

ELECTRICAL ENGINEER (Tramways).—Wanted immediately by the Council of the City of Wellington, New Zealand, a thoroughly qualified Electrical Engineer, who must have had special experience in carrying out and equipping overhead electrical tramways and power stations. Full particulars and conditions may be obtained on application to Messrs. R. W. Forbes & Son, Produce Exchange, New York, and applications must be delivered at the office of Messrs. John Duthie & Co., Ltd., Lime Street, London, E. C., England, not later than noon on the 20th July.

Inquiry No. 924.—For manufacturers of lightning rods.

IMPRESSED UPON HIS NOTICE.

The various features for which the Lackawanna Railroad has become noted are involuntarily impressed upon the notice of the passengers, who realize the luxury of hotel or club appointment in the electric lights; the smooth-running journals of the wheels; the extraordinary cleanliness made possible by the use of anthracite coal, avoiding all dust and nauseating smoke; the consciousness of being always on time—which comforts force an ease of mind and body most favorable to the enjoyment of the unsurpassed scenery through which its lines pass. It is but the natural sequence that the Lackawanna is prosperous in like degree to its excellence of service and its warm friends are equal in number to its whole list of patrons, for once to test its service means an ardent admirer and friend earned for the road.—Van Etten Breese.

Inquiry No. 925.—For parties to manufacture several thousand aluminium medals of a special character.

We do Experimental Special and Automatic Machine, Tool, Die and Model Work, also Metal Stamping. Racine Model Works, Racine, Wis.

Inquiry No. 926.—For manufacturers of stereoscopes.

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Inquiry No. 927.—For the address of the manufacturer of "Smith's Perpetual Calendar."

Inquiry No. 928.—For manufacturers of long wood handles for feather dusters.

Inquiry No. 929.—For the address of the manufacturer of the Diesel motor or oil engine.

Inquiry No. 930.—For manufacturers of aluminium tubing and piping and fittings for light machinery.

Inquiry No. 931.—For manufacturers of novelties for mail order and advertising purposes.

Inquiry No. 932.—For large lathes and planers.

Inquiry No. 933.—For machinists' hand taps, stocks and dies for threading bolts and pipes.

Inquiry No. 934.—For all sizes of nuts, locks, set screws, etc.

Inquiry No. 935.—For standard taper pin reamers and steel taper pins.

Inquiry No. 936.—For manufacturers of salt machinery.

Inquiry No. 937.—For manufacturers of dynamo storage batteries and motors for running presses requiring one to two h. p.

Inquiry No. 938.—For gasoline lamps which can be lighted without first heating the burner.

Inquiry No. 939.—For a fixture of 10 lamps to supply a room with gas from one generator.

Inquiry No. 940.—For a gasoline gas machine forcing gas through a house without generating same by heat, jets to be lit with a match.

Inquiry No. 941.—For second-hand dealers in 12 to 16-inch wrought iron pipe.

Inquiry No. 942.—For parties dealing in small engine castings and blue prints from which to build engines.

Inquiry No. 943.—For an improved method of screening sand or gravel.

Inquiry No. 944.—For manufacturers of cork in sheets of 4 x 12 inches by ¼ inch in thickness.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8226) A. S. D. asks: By what method can I coat glass plates with a clear transparent coating of gelatine? I desire a transparent gelatine coating similar to the coating on the regular gelatine-coated dry plate as used by photographers, but without the photographic properties, simply a clear transparent coating of the same texture. I have used the clear gelatine with alcohol and water, but it cracks and peels up for me. A. If we wished plates coated with gelatine we should buy photographic plates and remove the silver with hyposulphite of soda. The gelatine would remain clear and transparent, and with a uniform thickness far better than we could hope to make it ourselves. We can send you descriptions of the process of coating plates in SUPPLEMENT 272, 330, 467 and 1042, price ten cents each.

(8227) C. F. asks: 1. My son and one of his companions are making an electric motor as described in SUPPLEMENT No. 641. They follow directions as they understand them, but are not quite sure if correct. For the field magnet they used 33 feet of Russian sheet iron (of No. 24), but does not make 7-16 inch in thickness as described. It weighs 5⅛ pounds. Had they better put more iron to it so it will be 7-16 inch thick or is the 33 feet sufficient? A. The sectional area of the iron is important for the core of the magnet. Your boys had better wind on more wire to bring up the thickness to the specifications. 2. Does it make any difference if only one size of magnet wire is used to wind armature and field magnet? Have No. 18. Directions give No. 18 wire for winding the armature and No. 16 for the field. In list of dimensions of the parts the same size (No. 16) is given for both. A. The error in the size of wire is in the table of dimensions. The size of armature wire should be No. 18 as given in the description. 3. In winding the armature should the wire be wound *tight* or only moderately? So far in the winding the boys do not get as neat a job as they like to have, and suggest putting a strip of brown wrapping paper between every layer of wire: how would that do? A. The coils should be wound as tight as possible, and smooth. The high speed at which the armature turns makes it difficult to hold the coils in place unless they are well wound. It is not well to fill the space with paper, though if you get all the windings in and have space to spare, it may be done. 4. Is there any rule to calculate the area of a crescent? What is it? The water plant here has valves of different sizes (some are 4 inches in diameter) and a disk or circular plate a trifle larger is moved by means of a screw across the end of a 4-inch pipe, to open or shut off the water. Now how wide must this opening be to have the same area as 1-inch and 2-inch pipe? We can then calculate the amount of water that will flow through the other pipes. A. The simplest method for obtaining the area of any shape not easily calculated is to cut a piece of card of the exact shape and weigh it carefully on a jeweler's or druggist's balance, if an analytical balance is not to be had. Then cut a piece from the same card of a known size, four or five square inches, and weigh this, from which the weight of one square inch of the card can be found, and the weight of the irregular piece also.

(8228) W. H. K. writes: I have a solution of cyanide of silver for electro-plating in a glazed stoneware crock. The cyanide seems to go through and settle on the outside of crock in a dry, powdery form. 1. What causes this action and what will prevent it? A. The solution should not go through the glazing. It may be that the evaporation causes some of the crystals to climb over the edge of the crock, and to form down the sides of the jar. 2. Is the strength of solution correspondingly weakened, and would any of the silver go through along with the cyanide? A. The strength of the solution is not reduced if the crystals are formed in the manner we suppose. The silver is in the form of cyanide of silver, and is one substance, inseparable, not two substances as you suppose. 3. At the bottom of page 7, Watt's "Electro-Metallurgy," is described a battery; in constructing the copper cylinder should the edges be joined by soldering or lapped and hammered together, or how? A. The copper is not joined at all in the Daniell's cell. It is a sheet of copper rolled into the form of a cylinder.

(8229) G. D. Y. writes: Your favor of March 21 received; would state that it was not a hydrometer manufacturer that I was inquiring for, but for a formula to be printed in the SCIENTIFIC AMERICAN of how to convert Baume degrees into specific gravity degrees. Kindly state also on what principle is the Baume scale based, and give rule of conversion of grain degrees of vinegar into Baume degrees or specific gravity. A. The Baume hydrometer was one of the earliest forms of the instrument. It is a hydrometer of variable immersion, but of constant weight. It always displaces the same weight of liquid. Its scale is made as follows: The instrument is placed in distilled water and the point to which it sinks is marked. It is then placed in salt water and a second point noted. The distance between these two points is divided into a certain number of equal parts and the rest of the tube is graduated with the same divisions. There are two Baume scales, one for *light* and one for *heavy* liquids. For light liquids Baume took zero point at the place where the instrument stood in a solution of 10 parts salt and 90 parts water. The point to which it sank in distilled water was called 10 degrees, and the scale was graduated upward throughout its length on this basis. For heavy liquids, the zero point is found by placing the instrument in distilled water. It is then placed in a solution of 15 parts of salt and 85 parts water and the point determined is marked 15 degrees. From the distance between these points one degree is found, and the scale is graduated downward throughout its length on this basis. Both scales are scales of equal parts, and the degrees are not the same in the two scales. For a hydrometer of variable immersion the specific gravity scale is not a scale of equal parts, since the bulb at the bottom is not as large as the tube. If one were made of the same size throughout its scale would be one of equal parts. These are often used in school laboratories for purposes of instruction. From the above it should be evident that there is no formula of conversion from the Baume to the specific gravity scale. Conversion is a matter of comparison, and not one of calculation. Our correspondent should purchase two hydrometers, one for light and one for heavy liquids, upon whose stems both scales have been placed by the manufacturer. Or he should purchase a reference book containing these tables. We have not space to reprint what is in every reference book.

(8230) O. E. writes: I have made a Wimshurst machine according to the description in "Experimental Science," leaving off the outside plates and built the rest as it is most commonly seen, but can get only one-half inch spark. Will you please state a few things that hinder these machines from working well? Does the thickness of the glass have anything to do with it? Why would not connecting the plates together, as they are by the iron shafts, be a hindrance? Is a friction machine in any way superior to the induction? Will condensers increase the length of these sparks? Will copper sectors answer the purpose as well as tinfoil or brass? A. From your letter it is not certain that there is any trouble with your machine. It has no Leyden jars, and cannot give any but the effusive discharge, which is never long nor loud, but is a stream of sparks only. The machine is also exposed to the moisture of the air because you have not provided a case for it. This reduces its efficiency. The glass should not be unusually thick; but the most important feature of the glass is that it should not contain any lead. Ordinary window glass may be worthless for this use. The iron shaft has no effect on the spark, since the glass is an insulator and the electric charge cannot pass from the glass to the shaft. A friction machine would be far inferior to an induction machine made from the same materials. The metal of which the sectors are made is of no consequence. Any metallic foil or very thin sheet which can be attached to the glass firmly is good for the purpose.

(8231) C. G. C. asks: I wish to build the small fan motor described in the SCIENTIFIC AMERICAN, by George M. Hopkins, and would like to know whether strap iron of the same width and thickness as stovepipe iron would answer as well for the armature? A. Yes, any good quality of sheet iron will answer the purpose.

(8232) L. H. E. asks: Will you kindly tell me how to ascertain the horse power of an electric motor? A. To find the horse power of an electric motor measure the amperes it is taking and the voltage of the current. Multiply these numbers together, and divide the product by 746. That is all. It is very simple.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

June 18, 1901,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrasive sleeve, C. Brown 676,487
Acid concentrating apparatus, J. Patten 676,663
Acid concentrator, J. Patten 676,664
Advertising vehicle, L. Neumayer ..... 676,821 to 676,822
Air brake mechanism, W. H. Sauvage ..... 676,850 to 676,852
Alarm. See Burglar alarm.
Album, stereoscopic view, J. C. R. Miller 676,756
Animal trap, C. P. C. Miner 676,757
Animal trap, automatic, J. F. Hand 676,623
Automatic brake, D. H. Andrews 676,614
Baby walker, T. Sloan 676,634
Bag, C. C. Ely 676,578
Bag, M. E. Mogg 676,659, 676,660
Bag holder attachment for trucks, E. K. Abbott 676,731
Baking pan, I. H. Jones 676,609
Bale making apparatus, cotton, W. E. Anderson 676,597
Baling press, J. T. Hay 676,497
Baling press, J. Pegg 676,511
Baling press, P. C. Southwick 676,777
Barrels, machine for heading up slack, E. Holmes et al 676,819
Bearing, thrust, C. R. Pratt 676,769
Bed, F. Martin 676,544
Bed spring frame hook or support, C. R. Barker 676,652
Belt, conveyor, M. Lindsay 676,565
Berry box, H. C. Finley 676,653
Bevel cutting and punching machine, E. B. Stimpson 676,781
Bicycle coupling device, S. Elliott 676,535
Blast furnace, J. M. Hartman 676,692
Boat, electrically propelled, W. R. Edwards 676,738
Boiler, F. G. Rogers 676,632
Boiler furnace, G. W. Cary 676,734
Boilers, system of regulating steam, R. H. White 676,790
Book rest, H. L. Hazelwood 676,749
Book support, Parish & Land 676,443
Bottle, E. Ader 676,613
Bottle, non-refillable, F. Franz 676,715
Bracket, S. Lederer 676,563
Brake shoes, metallic insert for, W. A. Chapman 676,489
Bricks, composition of matter for, J. D. MacDonell 676,438
Briquet molding machine, R. A. Zwoyer 676,484
Broiler, B. P. Wagner 676,479
Brooch, T. J. Pollard 676,473
Brooches, pins, etc., automatic catch for, Theberath & Uhry 676,640
Broom stay and fiber support, E. C. Jones 676,540
Brush, cleaning, G. S. Leiner 676,845
Buckle, R. Scheuer 676,475
Building block, G. L. Mouchel 676,568
Building block, W. E. Shaw 676,803
Bung, J. Scior 676,701
Burglar alarm, O. J. Gatten 676,744
Bushing for casks, barrels, etc., bung, H. H. Gochnauer 676,622
Button, cuff, J. Goldsmith, Jr 676,655
Button for cushion seats, tufting, F. A. Neider 676,510
Buttoner, collar, A. S. Houston 676,556
Calcium carbid simultaneously with silicide of iron, making, W. Rathenau 676,514
Calipers, micrometer, F. Spalding 676,637
Can. See oil can.
Can opener, W. H. Plumb 676,726
Can opener, C. W. Weir 676,789
Candy and making same, J. B. Webb 676,707
Car brake, J. H. Gagnier 676,743
Car brake, wheel, C. V. Rote 676,516
Car construction, metallic, C. M. Carnahan 676,530
Car coupling, I. Bartlett 676,712
Car coupling, automatic, H. H. Ponton 676,547
Car, dump, F. Starkey 676,478
Car fender, street, G. A. Parmenter 676,768
Car mover, G. B. Sullivan 676,825
Car roof, Hutchins & Herbert 676,435
Car roof, railway, Hutchins & Herbert 676,434
Car step, automatic and adjustable, T. J. Schmidt 676,775
Carbonating apparatus, C. L. Bastian, ... 676,407, 676,408
Carbonater, C. L. Bastian 676,406
Carbureted air and vapor burner, combined, E. P. Woillard 676,522
Carding machine feeding device, T. Kershaw 676,541
Carpet cleaner, G. A. Cowgill 676,400
Cartridge loading machines, safety appliance for, G. M. Peters 676,472
Casket lowering device, J. M. Vail 676,804
Catamenial sack, D. P. Sonnehill 676,636
Cement kiln drying device, H. Stehmann 676,638
Chair, W. C. Wallis 676,788
Chance device, O. Weston 676,807
Checking or accounting for baggage, etc., sheet for, C. W. Hall 676,648
Checkrein hook, Begole & Anderson 676,527
Chuck, Z. T. Furbish 676,742
Cigar wrapper cutter, A. Du Brul 676,677, 676,813
Cigarettes, machine for making paper mouthpieces and inserting them in tubes of, Hagelberg & Lindelof 676,538
Cinematograph apparatus for reproduction in natural colors, W. N. L. Davidson 676,532
Circuit breaker trip, A. J. Purinton 676,849
Clock, watchman's, A. Newman 676,764
Clothes drier, T. A. Johnston 676,503
Coat holder, M. Mendels 676,650
Cock for train pipes of air brakes, angle, A. M. Applegate 676,598
Coffee boiler, C. O. Nelson 676,763
Coffee package and clarifier, combined, F. Willis 676,808
Coin freed automatic machine, J. W. Pearson 676,686
Collars, etc., pasting machine for, A. D. Fenwick 676,793
Composition of matter, S. Willner 676,828
Concentrating table attachment, W. G. Dodd 676,427
Concrete construction mold, P. T. L. Toelpe 676,785
Conditioning or drying apparatus, C. Mallinson 676,681
Cooking utensil lid, A. H. Drake 676,603
Cooking utensils, device employed in, A. Allendy 676,671
Corset fastening, Williams & Brownell 676,572
Counterpane, coverlid, or like woven fabric, Rumpf & Witty 676,446
Crane, J. W. Seaver 676,633
Cream separator, centrifugal, H. P. D. Ohlhaver 676,631
Curtain adjuster, V. V. Yost 676,710
Curtain support, J. N. Anderson 676,651
Cutter bar, rotatable, C. H. Wack 676,669
Cutter head, M. Meehan 676,754
Cutting articles from sheet material, machine for, J. J. Breach 676,457
Cutting fabric into bias-woven lengths, apparatus for, F. Newell 676,585
Cycle, motor, M. E. Toepel et al 676,592
Cylinder mold drive, B. B. Farnham 676,492
Derrick frame, portable, G. J. Gibbens 676,430
Disintegrator, E. Geisel 676,461
Display rack for ties, etc, D. M. Jacobs 676,560
Draft equalizer, S. H. Shipman 676,589
Draft regulator, thermostatic, Carney & Henderson 676,459
Drawer, extension, F. X. Ammann 676,596
Drawer, furniture, R. G. Hargrave 676,748
Drier. See Clothes drier.
Drying cylinder, B. Ormerod 676,684
Duster and window cleaner, S. I. Depew 676,425
Dye and making same, blue triphenylmethane, A. Hausdorfer 676,555
Dye, black disazo, H. Geldermann 676,494
Dye, blue disazo, H. Geldermann 676,495
Edged tools, making, C. D. Zeigler 676,832
Electric furnace, A. H. Cowles 676,575
Electric machine pole piece, dynamo, F. A. Merrick 676,439
Electric motor, A. P. Warner 676,520
Electrical apparatus, T. B. Kinraide 676,583
Electrically illuminated cross, H. J. Schlacks 676,853
Electrode, secondary battery, Abbey & Altmos 676,534
Elevator door and catch, I. S. McNaught 676,442
Elevator door operating device, H. Bitner 676,833
Elevator gate, F. L. Saino 676,474
Elevator safety device, H. M. Young 676,831
Embroidering machine attachment, E. & R. Cornely 676,422
Engine speed regulator, gas, B. Abel 676,811
Engine starting mechanism, explosive, J. Walrath 676,642
Engines, ignition plug for gas, N. McClintock 676,408
Envelop, A. D. Rossiter 676,515
Evaporating apparatus, T. J. Rayner 676,770
Exercising machine, R. Reach 676,771
Fan motor support, F. P. McBerty 676,441
Fan, rotary, H. M. Turner 676,786
Faucets, etc., sealing device for, I. J. French 676,580
Fence post puller, H. A. Bergom 676,599
Fillet cutting machine, Schmitt & Webster 676,728
Firearm, magazine, Young & Barton 676,809
Fire kindler or similar apparatus for mixing air and fluid, R. Ferguson 676,536
Fire resisting and ventilating floors and ceilings, method of and means for constructing, W. Seefels 676,802
Fish hook attachment spoon attachment, A. D. Weiss 676,521
Fish line attachment, McCargar & Hurlburt 676,724
Fishing rod tip, W. Friedlander 676,554
Flash light apparatus, C. Mills 676,545
Fluid package filter, C. F. Ruschaupt 676,772
Fluorin compound and making same, J. A. Reich 676,548
Folding machine, Downing & Wendt 676,533
Freezing apparatus, J. Patten 676,662
Fruit, apparatus for steaming and spicing dried, C. E. Hale 676,608
Fruit gather, T. C. Blackburn 676,411
Fumigator, formaldehyde, L. Feval 676,814
Furnace fire arch, Green & Gent 676,606
Furnace fire gate, Green & Gent 676,605
Furnace inspection door, Green & Gent 676,607
Furnaces, electrode connection for electric, A. H. Cowles 676,576
Furniture attachment, knockdown, C. S. McNown 676,509
Game, F. D. Fuller 676,581
Game apparatus, A. F. Zimmerman 676,455
Game table, C. W. Stroud 676,639
Garden tool, S. F. Burton 676,416
Garment fastener, N. J. Young 676,810
Garment press and case, G. E. & E. C. Brower 676,458
Gas, apparatus for ascertaining the density of, M. Arndt 676,858
Gas burner, C. S. Steward 676,451
Gas burner, incandescent, F. Logan 676,721
Gas engine, M. L. Wood 676,523
Gas generator, acetylene, W. J. Beaulieu, ... 676,615, 676,616
Gas generator, acetylene, Merrill & Hickman 676,628
Gas generator, acetylene, R. Federroll 676,691
Gas generator, acetylene, G. Seagrave 676,702
Gas generator, acetylene, A. C. Einstein 676,791
Gate. See Elevator gate.
Gate, J. F. L. Ellis 676,429
Gearing, I. H. Venn 676,641
Gearing, machine, E. Oredalen 676,610
Girdle, Warren & Sherin 676,571
Glass counter blank, J. McLoughlin 676,799
Glass, manufacture of sheet, P. T. Sievert 676,612
Glassware, apparatus for fire polishing and finishing, F. Woodruff 676,551
Glassware, apparatus for severing articles of, A. Roemisch 676,698, 676,699
Go-cart, J. J. Flannery 676,741
Gold separator, L. D. Carter 676,419
Golf ball, Knight & Peck 676,506
Governing system, speed, S. S. Ekman 676,739
Grain drill, W. A. Van Brunt 676,593
Grass hook, W. J. Henry 676,717
Grinding appliance, tool, C. V. Boys 676,413
Grinding machine, C. F. Roper 676,700
Grinding machine, ball, C. C. Hill 676,718
Guitar, W. W. Oakes 676,470
Harvester truck, J. F. Steward 676,780
Head rest, O. A. Ninceheiser 676,765
Heating and lighting apparatus, oil reservoir or container for, J. R. Bouhon 676,674
Heating furnace, A. Magnuson 676,566
Hitching device, horse, I. W. & H. Casser 676,837
Hockey stick, W. Dean 676,736
Hoeing machine, G. W. Stacy 676,705
Hogshead, J. Richards 676,587
Hoisting broom, J. C. Hoshor 676,626
Holdback strap fastener, M. M. Maxam 676,683
Hook and eye package, T. D. Richardson 676,824
Hoop driving machine, barrel, B. Holmes 676,844
Hoop riveting machine, Rust & Fisher 676,588
Hose or pipe nozzle, A. Anderson 676,526
Hot air furnace, R. S. Thompson 676,784
Hub and box therefor, wheel, E. H. Wagener 676,856
Hydrocarbon burner regulator, automatic, A. C. Stewart 676,518
Ice cream bricks, water ices, or the like, receptacle for, M. L. Beaver 676,486
Ice machine, J. Patten 676,666
Ice, manufacturing, J. Patten 676,668
Injector for forcing hot air, L. O. Boeing 676,673
Inking device, W. L. Morris 676,760
Inking pad, J. B. Laughton 676,752
Internal combustion engine, gas, petroleum, or like, H. Schwartz 676,449
Jar closure, E. Schifferly 676,774
Journal box, A. C. Pessano 676,471
Keyhole guard, W. Schwartz 676,450
Knife-cleaning machine, Samuels & Williams 676,773
Lacing stud machines, raceway for, W. C. Bray 676,414
Lamp burner, alcohol, G. E. Savage 676,447
Lamp, incandescent, C. Hoelscher 676,843
Lath and straightener, door, F. R. Stahl 676,779
Latent heat engine, O. P. Ostergren 676,800
Leather working machine, J. B. Donnelly 676,428
Leg, artificial, Erickson & Nilson 676,553
Life preserver, E. P. Brown 676,836
Linens, cottons, etc., shrinking and finishing, W. Hebdon 676,462
Liquid separator, centrifugal, J. J. Berrigan 676,410
Lock, W. Schlueter 676,448
Lock, J. Paur 676,823
Locomotive, Pitkin & Sague 676,696
Locomotives, device for rotating driving-shafts of, C. S. Mills 676,446
Loom picker stick buffer, F. A. Mills 676,658
Loom shuttle checking and releasing mechanism, Fairburn & Hargreave 676,491

(Continued on page 413)

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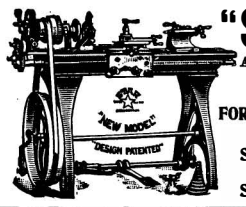

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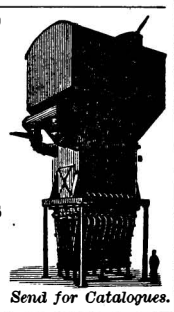

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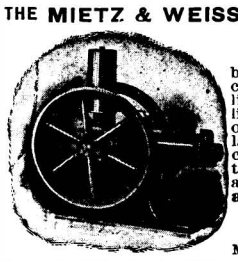

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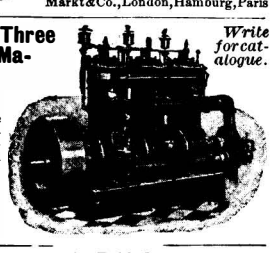

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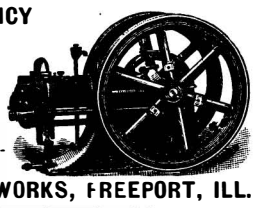

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Magnetic separating apparatus, T. A. Edison	676,840, 676,841
Magnetic separator, T. A. Edison	676,618
Mail box, C. O. Giere	676,431
Mail pouches to railway catchers or cranes, attachment for fastening, L. L. Henry	676,693
Masonry, etc., fire and dry-rot proof air-tight, C. Lorenc	676,507
Massage instrument, L. S. Fritze	676,604
Match box, C. P. Mullins	676,798
Match making machine, M. San	676,727
Measuring mechanism, liquid, A. Haas	676,656
Mechanical movement, E. Gundlach	676,537
Metal feeding and melting mechanism, Grogark & Dickson	676,496
Mine gate, N. K. Bowman	676,835
Miner's squib, I. T. Jenkins	676,502
Mold. See Concrete construction mold.	
Mop, H. A. Hayden	676,624
Mop wringer, H. A. Hayden	676,625
Music leaf turner, F. S. Duell	676,737
Myrioscope, automatic, A. Peterson	676,445
Nut lock, G. W. Small	676,477
Nut lock, O. W. McCarron	676,546
Nut lock, W. S. Ellifrits	676,678
Oil can, W. X. Owen	676,767
Oil cup, J. M. King	676,561
Ordnance, J. W. Kline	676,649
Ore concentrator, T. Dynan	676,534
Ore roasting apparatus, H. Carmichael	676,417
Ores, roasting, H. Carmichael	676,418
Ores, separating metallic from rocky constituents of, F. E. Elmore	676,679
Ornamental fabric, J. Macadam	676,657
Oven, baker's, C. E. Hogberg	676,464
Overall suit, union, McDaniel & Singrey	676,847
Oxidizing apparatus, A. N. Dubois	676,647
Package for semi-solids, non-refillable, L. Blatz	676,834
Paint casks, composition for lining, G. A. Will	676,550
Pan, S. I. Depew	676,424
Paper boring bit, J. M. Kollmyer	676,720
Paper box, W. B. Grim	676,747
Paper cutter, W. F. Hutchinson	676,795
Pen, drawing, J. M. Barnay	676,711
Penstock motor, A. Ferguson	676,842
Perforating machine, H. Hollerith	676,433
Pie rack, A. O. Bohem	676,732
Piles, protecting wooden, S. L. Shuffleton	676,704
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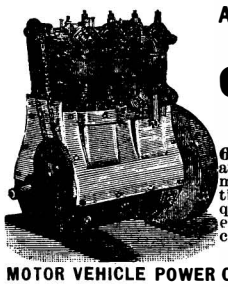

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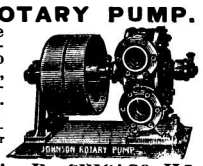

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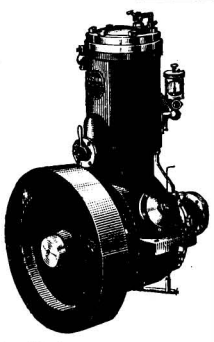

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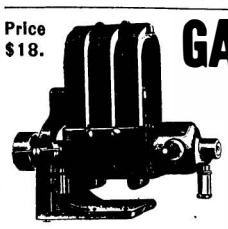

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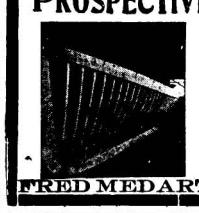

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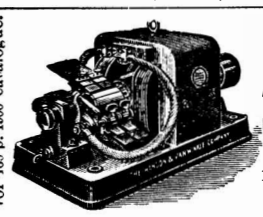

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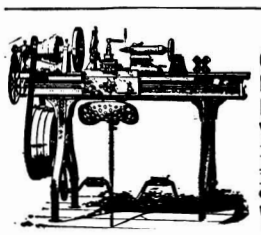

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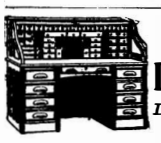

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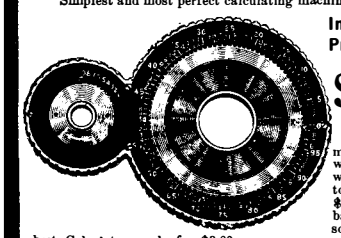

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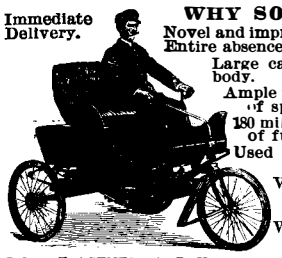

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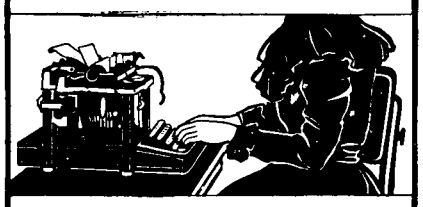

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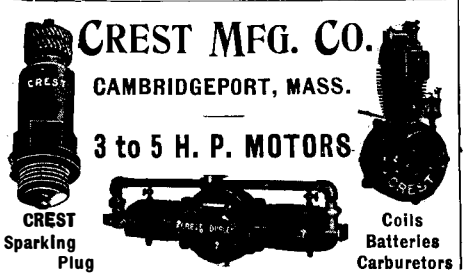

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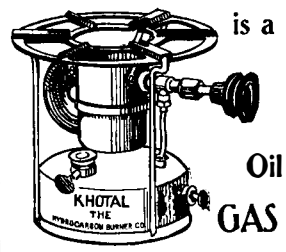

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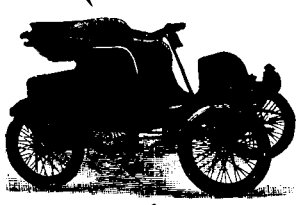

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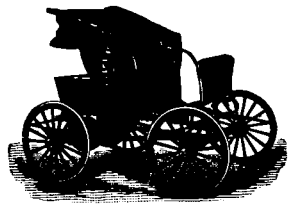

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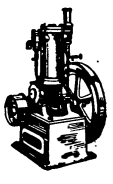

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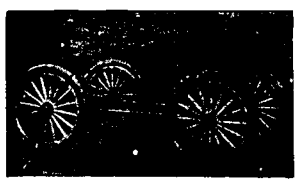

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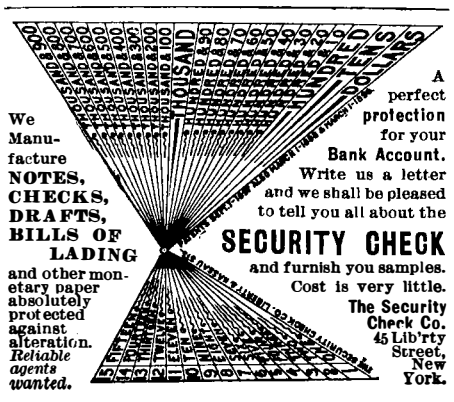

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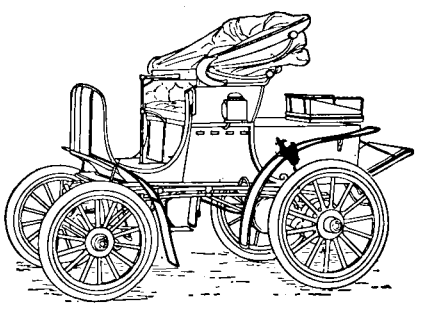

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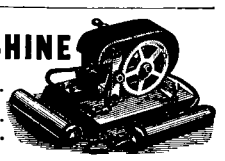

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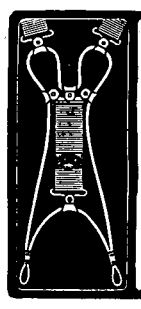

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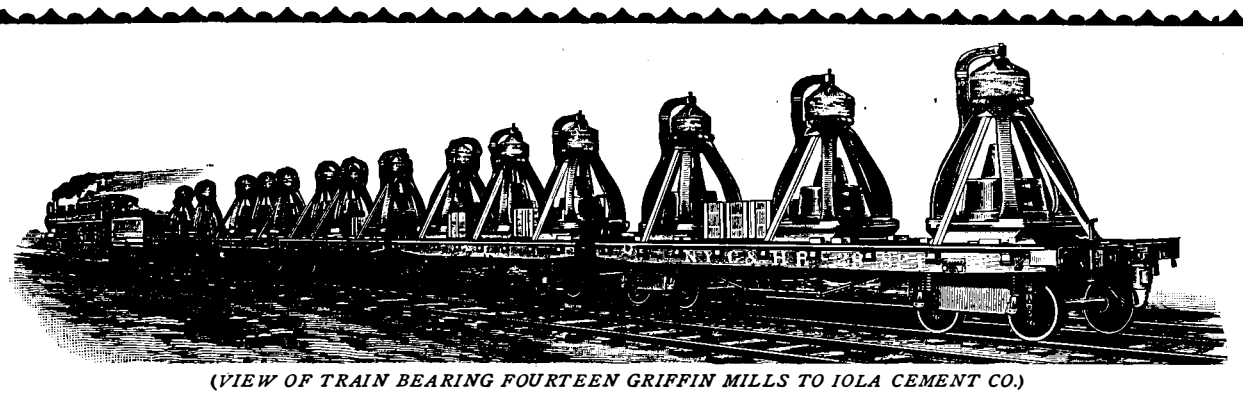

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ILLUSTRATIONS.

A

Accident, docking, curious.. 404
Acropolis of New York..... 136
Aeroplane, Kress..... 137
Airship, dirigible..... 10
Allen, F. I..... 227
Alternator, Parsons..... 260
Ant life, new features..... 265
Aqueduct, Jerome Park..... 342
Arc circuit, whistling..... 358
Arc lamp, Rasmus..... 250
Army transport service..... 177
Asphalt industry, Trinidad, 161, 166
Assouan dam..... 273
Auto-commutator, telephone.. 85
Automobile, electric, Krieger 357
Automobile, gasoline..... 148
Automobiles, De Dietrich..... 120
Automobiles, gasoline..... 57

B

Bagworm 330
Balance, actinic..... 11
Balloons at Vincennes..... 232
Barometer, mercurial..... 74
Basaltic columns..... 68
Basin, model, U. S..... 341
Bat, giant, of Philippines.... 35
Battery, gas, new..... 310
Battery, storage, Edison..... 376
Battle of Santiago..... 121
Battleship Czarovitch..... 212
Bayonet exercises..... 324
Bean weevils..... 298
Beaumont oil well..... 74
Bee's sting..... 329
Bending rails..... 200
Berlin subway..... 84
Bicycle, foot and hand..... 73
Bicycle joint, hydraulic..... 324
Blackboard eraser, cleaner... 250
Boat, submarine, Turkish... 280
Boiler explosion..... 228
Boiler explosions..... 24
Boiler feed, Rice..... 263
Boiler, solar motor..... 169
Boiler, the Vanderbilt..... 100
Bolometer, the..... 11
Bookholder, new..... 154
Boonton's forge..... 165
Brake, electric..... 216
Brasses and bearings..... 21
Broaching machine..... 21
Breech plug, new..... 75
Brick carrier..... 378
Bridge, East River..241, 246, 369
Bridge, London, widening.... 89
Brontosaurus 184
Bunk for cars and ships..... 170
Buoy, petroleum..... 117
Burner, hydrocarbon..... 218

C

Cacti of California..... 149
Camera, the largest..... 134
Canals, Canadian..... 89
Candlestick, miners'..... 58
Cannon, weather..... 260
Capsuling machine..... 138
Car brake, electric..... 216
Car fender, Watson..... 372
Car ferries..... 40
Car mover, Kurtz's..... 282
Cars, pressed steel..... 385
Cars, street, old, utilizing... 409
Carburetor, De Dietrich..... 120
Carriage, motor, De Dietrich. 121
Casts, plaster, large..... 249
Ceiling switch..... 170
Celtic, launch of..... 276
Ceratosaurus 184
Channel, irrigation..... 53
Chimney, concrete..... 308
Chimneys, tall..... 21
Cigar factory..... 309
Cliff dwelling park..... 297
Clipper grinder, new..... 122
Clock, ingenious..... 7
Clock, perpetual motion..... 276
Clock, Russian, novel..... 52
Cocoa pods..... 360
Coil, induction, new..... 7
Collar for shafts..... 170
Columns, basaltic..... 68
Constitution, launch of..... 312
Constitution, yacht..... 289, 389
Copper mining in America... 356
Copy holder, new..... 154
Corn, pod..... 135
Cotton gin..... 218
Coupling, the Zodel..... 21
Cruiser Montcalm..... 10
Curie, experiments of..... 346
Cushion for vehicles..... 362
Cutler's shop at Exposition.. 90
Czarovitch, battleship..... 212

D

Dam, Assouan..... 273
Derrick 250
Dinosaurs, three..... 184
Dock, dry, floating..... 377
Doorlatch, refrigerator..... 138
Dredge, dipper, powerful..... 116
Dredger, new..... 25

E

East River Bridge.....241, 246
Electrograph, the..... 372
Elevator, water..... 104
Ellipsograph, an..... 106
Engine, rotary, Porter..... 201
Engines, hoisting..... 116
Eucalyptus, blossom..... 149
Excavations at Nippur..... 129
Experiments of M. Curie..... 346
Explosion, boiler..... 228
Explosions, boiler..... 24
Exposition, Pan-American.... 361

F

Farming, irrigation..... 53
Faucet, automatic..... 404
Feathers, ostrich..... 161
Fender, car, Watson..... 372
Ferries, car..... 40
Field glass, military..... 10
Fifth-wheel, novel..... 282
Fire-alarm, pyrotechnic..... 6
Fire hydrants, valve for..... 122
Floor, East River Bridge..... 369
Flying machine, Hofman's... 281
Flying machine, new..... 72
Flying machine, Whitehead's. 357
Forge, Boonton's..... 165
Fomentations, press for..... 75
Fountain, ice..... 328
Fountains, electric..... 212
Frost valve, automatic..... 292
Fulton, launch of..... 388
Furnace, electric..... 180

G

Gas battery, new..... 310
Gas, water, apparatus..... 97
Gas, water, manufacture..... 33
Gasoline runabout.....57, 148
Gasoline tri-moto vehicle..... 73
Gin, cotton..... 218
Glass, plate, industry..... 305
Goose, tailor's..... 202
Gramophone 260
Grapevine moth..... 394
Gray, Elisha..... 72
Grazing pen, moving..... 245
Gumming, saw, machine..... 66
Gun, disabled, of Kearsarge.. 345
Gun, Gathmann..... 313
Gun, Maxim, latest..... 248
Gun, rapid-fire..... 20
Gun-stock, adjustable..... 410
Gun, torpedo..... 314
Gun, weather..... 260
Guns, British, modern..... 248
Gyroscope, electrical..... 245

H

Hammer, power, new..... 388
Harbor, New York..... 26
Harvesting a rice crop..... 53
Hawk, tarantula..... 202
Hay stacker..... 250
Hinge, locking..... 106
Hoisting device..... 36
House, moving a..... 56
Howitzer, 6-inch..... 248
Hydrants, valve for..... 122
Hygroscope 36

I

Ice conveyer, new..... 308
Ice fountain..... 328
Igniter, Roche.....*292
Independence, yacht.... 193, 389
Induction coil, new..... 7
Ink well, fracture of..... 84
Insect, interesting..... 330
Insect parasite, an..... 394
Insulator, Woolbert..... 106
Inventions, recent..... 75
Iron rose..... 296
Irrigation ditch..... 20
Irrigation, farming..... 53

J

Jerome Park reservoir....337, 342

K

Kearsarge, disabled gun of.. 345
Korea, launch of the..... 228

L

Lamp, arc, Rasmus..... 250
Lamp, Cooper Hewitt..... 266
Lamp for buoys..... 117
Lamps, lens for..... 84
Lathe for columns..... 17
Launch of the Celtic..... 276
Launch of Constitution..... 312
Launch of the Fulton..... 388
Launch of the Korea..... 228
Launch of the Ohio..... 353
Launch of Shamrock II..... 293
Lens, tubular, for lamps..... 84
Life guard, Watson..... 372
Lighting, train, from axle.... 56
Line, electric, Valtellina..... 408
Locomotive boiler..... 100
Locomotive, electric..... 168
Locomotive, express..... 165
Locomotive, express, German. 49
Locomotive, petroleum..... 36
Low, Seth B..... 373
Lubricator, Slater..... 234
Lysistrata, yacht..... 372

M

Mail-box, improved..... 404
Man, truncated..... 105
Mantis religiosa..... 105
Map of Canadian canals..... 90
Map of Jerome Park..... 342
Marble, testing..... 393
Mastodon, Brooklyn..... 312
Maximite, tests of..... 325
Mercury bath, Hamy..... 388
Metal beater, Thurston..... 27
Metal and woodworking..... 2 82
Millinocket mill, map..... 230
Mining, copper, American.... 356
Mirograph 37
Model-basin, U. S..... 341
Moore, Edward B..... 275
Mortising machine..... 346
Mosquito cage..... 314
Motor carriage, De Dietrich.. 120
Motor-cycle 57
Motor, De Dietrich..... 120
Motor, gasoline..... 57
Motor, solar, boiler..... 169
Motormen, school for..... 209
Mounds at Nippur..... 134
Mutoscope, the..... 196

N

Needle point..... 329
New York, acropolis of..... 136
New York harbor..... 26
Niagara Falls power plant... 229
Nile reservoir, the..... 273
Nippur, excavations at..... 129
Nut, relief..... 75

O

Observatory, astro-physical.. 11
Ohio, launch of the..... 353
Oil burner, wickless..... 218
Oil well, Beaumont..... 74
Orange peel, object of..... 88
Orchestra man, the..... 117
Ordnance, British..... 248
Ore unloader..... 153
Omnigraph, the..... 216
Ostrich feathers..... 164

P

Pail, fish bait..... 154
Pan-American Exposition.... 361
Park, cliff-dwelling..... 297
Pen, Fowler..... 250
Pendulum beats, adjustment. 122
Pepper tree, the..... 149
Petroleum buoy..... 117
Petroleum well, Beaumont... 74
Philippine, transport..... 262
Philippines, transport service. 177
Phosphorus, production of.... 180
Photomicrography 329
Pile driver, new..... 232
Pine needle industry..... 344
Pipe, steel, manufacture.... 200
Pipe and stud wrench..... 186
Pipe wrench..... 218
Piping, wood..... 6
Pipe wrench, new..... 138
Pitch lake, Trinidad....161, 166
Plate planing machine..... 200
Plow, double-share..... 263
Pod, corn..... 135
Potter of Old Berry..... 135
Power plant, Niagara Falls.. 229
Press for fomentations..... 75
Prinzessin-Victoria-Luise, yacht 81
Procris, caterpillar of..... 394
Provisioning transatlantic liner 401
Pump, self-measuring..... 378
Pump valve gear..... 154

R

Racing machine, De Dietrich. 120
Radio-conductor, Popoff..... 324
Radiograph, stereopticon..... 245
Railroad accident, peculiar... 184
Railway tie, metal..... 362
Railway tunnel, Boston..... 185
Railway, underground, Boston 69
Railway viaduct..... 340
Railways, steep, in the U. S.. 65
Raisin industry, the..... 3
Rapid transit tunnel..... 321
Ray, X, work..... 245
Razor blade magnified..... 329
Refrigerator door latch..... 138
Reservoir, Jerome Park..337, 342
Rice farming..... 53
Rocking-chair and cradle.... 410
Rocks, flow of..... 393
Rose, iron..... 296
Runabout, gasoline.....57, 148

S

Sad-iron, new..... 202
Salt deposits..... 217
San Gimignano..... 148
Saw setting machine..... 68
School for motormen..... 209
Scorpion 202
Screw-eye driver..... 292
Seat, supplemental, vehicle.. 362
Sedgwick, transport..... 177
Shaft, repair of, at sea..... 122
Shamrock under sail..... 328
Shamrock II., launch.....*293
Shamrock II., yacht..... 389
Sheep fold, moving..... 244
Shells, maximite..... 326
Signaling, submarine..... 73
Silk industry apparatus..... 113
Silkworm, the..... 118
Skeleton combat..... 38
South Portland steamer..... 261
Spectrum of rock salt..... 11
Spider, trap door..... 202
Spring for vehicles..... 362
Spyglass, military..... 10
Steamers, stern wheel..... 244
Seamships, submerged, raising 261
Steel car industry..... 385
Steel pipe, manufacture..... 200
Stegosaurus 184
Still, pine oil..... 344
Stralau-Treptow tunnel..... 392
Stud and pipe wrench..... 186
Subway, Berlin..... 84
Sugar cane culture..... 213
Sugar juice weighing machine 186
Switch, ceiling..... 170
Switches, magnetic..... 169

T

Tailor's goose..... 202
Tarantula 202
Telegraph, fac simile..... 373
Telegraph, page-printing..... 181
Telegraph, printing, Murray 277, 278
Telegraphy, teaching..... 216
Telegraphy, wireless, app..... 324
Teleg aphy, wireless, duplex. 152
Telegraphy, wireless, steering by..... 101
Telephone, auto-commutator. 85
Telephone system, Chinese... 376
Telephone wire, paying out.. 58
Temple of Bel..... 135
Third rail system, Baltimore. 168
Tie, railway, metal..... 362
Tobacco industry..... 309
Topophone, the..... 197
Torpedo, aerial, electric..... 10
Torpedo shell..... 314
Torpedo, steering..... 101
Toy, mechanical..... 27
Train lighting, car axle..... 56
Transport service, Philippines 177, 257, 262
Trees of California..... 149
Tri-motor vehicle..... 73
Trinidad, pitch lake.....161, 166
Trolley pole guard..... 308
Try-square, new..... 122
Tube expander, Burton..... 52
Tunnel, railway, Boston..... 185
Tunnel, rapid transit.....37, 321
Tunnel, Stralau-Treptow..... 392
Turbine, Parsons'..... 260
Turbine plant, Rodney Hunt.. 225
Typesetting machine..... 145
Typewriter pictures..... 75

V

Vaccine virus..... 41
Vacuum pump, preserve jar.. 75
Valve, frost, automatic..... 292
Valve mechanism for hydrants 122
Valve motion, pump..... 154
Valve, reducing..... 134
Vehicle, curious..... 410
Viaduct, railway..... 340
Village, disappearing..... 296
Virus, vaccine..... 41
Vise, bench and pipe..... 101

W

Water gas apparatus..... 97
Water gas manufacture..... 33
Water supply, New York.337, 342
Water system, Chicago..... 405
Water wheels, ingenious..... 104
Weather gun..... 260
Weevils, bean..... 298
Weighing machine for liquids. 186
Whale, the gray..... 121
Wheat hospital, a..... 264
Wheel, fifth, novel..... 282
Wheels, current..... 104
Windmill, novel..... 104
Wood and metal working..... 282
Wood piping..... 6
Worm gear, ball-bearing..... 27
Wrench, pipe..... 218
Wrench, pipe, new..... 138
Wrench, pipe and stud..... 186

Y

Yacht Constitution..... 289
Yacht Independence..... 193
Yacht Lysistrata..... 372
Yacht Prinzessin-Victoria-Luise 81
Yacht racing development... 233
Yachts, cup, of 1901..... 389

Z

Zea tunicata..... 135

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

A

Academy of Sciences, National 259
Accumulators, test of..... 263
Acetylene, at Pan-American Exposition 327
Acetylene automobile..... 119
Acetylene gas vs. petroleum. 250
Acetylene, hydrogen from.... 371
Acetylene searchlights..... 329
Acid, tungstic, estimation... 131
Accident, docking, curious..*404
Aeronautical congress..... 130
Aeronautics in 1900..... 5
Aeroplane, Kress.....*137
Air compression, hydraulic... 354
Air, liquid, as blasting agent. 290
Air resistance of trains..... 83
Airship, Da Schio..... 83
Airship, the Kress..... 50
Airships, dirigible..... *10
Alaska, grain in..... 99
Alcohol, action on metals.... 359
Alcohol as fuel for motors... 344
Alcohol motors..... 362
Alexandra Palace, London... 8
Alkaloids, new, of tobacco... 218
Allen, F. I.....*227
Alps, a tour of the..... 119
Alternator, Parsons'.....*260
Aluminium cooking utensils.. 307
Aluminium, manufacture in Great Britain..... 151
Aluminium transmission..... 98
Aluminium, welding..... 23
Amalgam, ammonium..... 292
Amber, a unique piece..... 23
Ambulances, motor-driven... 119
Ammonium amalgam..... 292
Animal tissue, experiments.. 163
Animals, wild, in winter..... 323
Ant life, new features in....*265
Arc, electric, music from.... 131
Arc lamp, Rasmus.....*250
Arc, whistling.....*358
Arch, memorial, naval..... 162
Archaeological news.....119, 231
Armstrong, Lord..... 19
Army and marine, Russian... 195
Army officers, U. S..... 307
Army transport, abolition.... 306
Arsenic in the hair..... 244
Asphalt, Trinidad.....*166
Athens observatory..... 42
Atmosphere, hydrogen in..... 231
Auto-commutator, telephone.. *85
Automobile, acetylene..... 119
Automobile and train race... 150
Automobile, army..... 167
Automobile in the army..... 102
Automobile device wanted.... 107
Automobile Exhibition, Vienna 119
Automobile, gasoline.....*148
Automobile industry of France 375
Automobile in Klondike..... 163
Automobile, the Krieger.....*356
Automobiles in Madagascar.. 310
Automobile mitrailleuse..... 343
Automobile news, 22, 54, 70, 87, 102, 119, 135, 150, 167, 183, 199, 214, 247, 263, 310, 326, 343, 358, 375, 390, 407
Automobile passenger car.... 310
Automobile service in Tunis.. 135
Automobile show.....*73
Automobile show, Paris..... 102
Automobile race, speed..... 402
Automobile work at Nice..... 226
Automobiles, De Dietrich....*120
Automobiles, electric..... 390
Automobiles, gasoline..... *57
Automobiles, heavy-weight test 343
Automobiles in New York.... 211
Automobilism in 1900..... 5
Automobilism, military..... 358
Automosled, the..... 87
Auto-sparker, the..... 310

B

Bacteria produce gases..... 262
Baggage check system..... 233
Bagworm, the.....*330
Balance, actinic, the..... *11
Baldwin-Ziegler expedition... 275
Balloons at Vincennes.....*232
Ballooning, long distance.... 35
Baptistry of Florence, restoration 231
Barber shop, antiseptic..... 330
Barometer for balloons..... 231
Barometer, mercurial..... *74
Basaltic columns..... *68
Basilica of the Virgin..... 151
Basin, model, U. S.....*341
Bat, giant, of Philippines.... *35
Bath, mercury, form of the. *388
Battery, gas, new.....*310
Battery, storage, Edison.338, *376
Battle of Santiago.....*121
Battleship Czarovitch.....*212
Battleship, our fastest..... 386
Battleships, Japanese..... 231
Battleships unprovided for... 226
Bayonet exercises, Russian...*324
Bean weevils.....*298
Beaumont oil well..... *74
Beer, arsenical poisoning by.. 243
Beer from beet roots..... 167
Beer-cooling mixtures, prize.. 51
Beer-cooling, prize for..... 344
Berlin, subway of..... *84
Bicycle in 1900..... 5
Bicycle joint, hydraulic.....*324
Bicycle show, annual..... *57
Bicycle, speed records..... 34
Biggest in the world..... 402
Blackboard erasers, cleaners.*250
Blasting agent, liquid air as. 290
Bleaching, new method..... 36
Blood spots, recognizing..... 42
Boa, tree, California..... 23
Boat for south polar expedition 134
Boat, submarine, Turkish....*280
Bodies less than atoms..... 306
Boiler construction, point in.. 98
Boiler explosion, a.....*228
Boiler explosions..... *24
Boiler feeder, Rice.....*263
Boiler, locomotive, Vanderbilt *100
Boiler of solar motor.....*169
Boiler, water tube..... 210
Bolometer, the..... *11
Book holder, new.....*154
Boonton forge, the.....*165
Botanical Garden Museum ...227
Botany, institute, Regent's Park 71
Brake, car, electric.....*216
Brake that works..... 34
Brake, train, results..... 290
Breech plug, new..... *75
Bressa prize..... 154
Brick carrier, new.....*378
Bridge, East River.....*246
Bridge, East River, cables... 130
Bridge, East River, floor.....*374
Bridge, ferry, colossal..... 86
Bridge, London, renovation... 183
Bridge, London, widening.... *88
Bridge, North River..... 274
Bride, stone arch, longest.... 358
Broaching brasses..... *21
Build, are you about to?..... 115
Bullet, modern infantry..... 374
Bullets, explosive effects..... 247
Bunk, folding, for cars.....*170
Buoys, petroleum.....*117
Burner, oil, wickless.....*218
Business column, our..... 115
Butter, cocoanut..... 282
Butter packing..... 404

C

Cab, electric, service, Paris, 135, 390
Cable systems, test of..... 338
Cable, telegraph, longest..... 163
Cable, Trans-Pacific..... 323
Cables for East River bridge. 130
Cacti of California.....*149
Calcium carbide, price scales. 327
Camera, the largest.....*134
Canada, canals of.....*89, 290
Canada, electric railways of.. 292
Canal, drainage, Chicago..... 290
Canal, Erie, muddle..... 242
Canal, Erie, new..... 210
Canal, Mosel-Saar..... 88
Canal, Sault Ste. Marie..... 19
Canal, Suez..... 210
Canal, Suez, traffic..... 183
Canals of Canada..... 290
Canals, electric traction on... 78
Candlestick, miners'..... 58
Cannon, weather, new..... 260
Capsuling machines.....*138
Car brake, electric.....*216
Car fender, Watson.....*372
Car ferries, American..... 40
Car kitchen, a..... 293
Car mover, simple.....*282
Car, passenger, automobile... 310
Car, trolley, fast..... 87
Car, trolley, funeral..... 118
Cars, pressed steel.....*391
Cars, street, old, utilizing..*409
Carbide, market for, in India. 71
Carbon chlorides, production..*180
Carburants, test of..... 358
Carpets, Oriental, new method 343
Carrara marble..... 55
Carthage, excavations at.... 371
Casts, plaster, large.....*249
Cave, wind, Black Hills..... 328
Ceiling switch..... *170
Celluloid, new..... 371
Cellulose, nitro, powders..... 274
Celtic, steamer, launch of...*276
Cement gasholder, a..... 342
Cement for South Africa..... 372
Cerigo Island, discoveries at. 251
Channels, dredgers for..... *25
Charleston Exhibition..... 122
Chicago drainage canal..... 290
Children, German, education. 362
Chimney, a concrete.....*308
Chimney, a large..... 39
Chimneys, tall..... *21
Christmas Island..... 310
Cigarettes vs. cigars..... 387
Cigars, cigarettes and pipes.. 387
Cinematograph for the blind..*201
Cities, future, areas of..... 393
Clarke, T. C., death..... 403
Cliff-dwelling park.....*297
Clipper grinder, new.....*122
Cloaca Maxima, discovery of. 51
Clock faces, illuminated..... 311
Clock, perpetual motion.....*276
Clock, Russian, curious..... *52
Clock, a wonderful..... *7
Clothing of ancient Romans.. 387
Coal, anthracite, size..... 215
Coal in Australia..... 294
Coal, high price, England.... 86
Coal regions, Germany's two.*153
Coal, scarcity, in Russia..... 55
Coal, Spitzbergen..... 374
Coal, substitute for..... 231
Coatzacoalcos harbor..... 23
Cobalt, compounds of..... 154
Cobalt specific heat..... 217
Cocaine sniffing..... 323
Cocoa cultivation.....*360
Cocoanut butter..... 282
Coherer in storm detection... 242
Collar, safety, for shafts.....*170
Columns, basaltic..... *68
Comet, Encke's, return..... 371
Comet, Giacobini..... 407
Commissioner of patents, new.*227
Compounds, chemical, new... 242
Congress, aeronautical..... 130
Conjunctiva, irritation..... 376
Constitution, launch of.....*312
Constitution, yacht.... 295, *389
Consumption, decomposed light in 179
Copper casting..... 217
Copper mining in America...*356
Copy holder, new..... 154
Copyright decision..... 134
Copyrights in 1900..... 390
Corn, pod.....*135
Cotton gin, new.....*218
Cotton growing, Cuba..... 278
Cotton mills, first cost..... 291
Cotton industry, Southern.... 243
Coupling, the Zodel..... *21
Cruiser, armored, discussion 247, 279
Cruiser Montcalm..... *10
Cruisers, armored, new...135, 183
Cruisers, armored, our..... 103
Cruisers, German, reconstruction 402
Cruisers of the St. Louis class 87
Cruisers unprovided for..... 226
Cuba, cotton growing in..... 278
Cupellation 119
Cup-yacht designing..... 194
Cup yachts, three, 1901..... 389
Curie's experiments.....*346
Curiosity and science..... 162
Current of 3,000 volts..... 178
Cutler's shop at Exposition... *90
Cycling industry, England... 103
Czarovitch, battleship.....*212

D

Dead Sea, rise in..... 199
Derailment, curious..... 375
Derrick, novel.....*250
Dinosaur, the great..... 291
Dinosaurs, American.....*184
Directory, penny-in-the-slot.. 151
Disaster, ferryboat..... 402
Dock, dry, floating.....*377
Document 384, Congress..... 362
Door latch, refrigerator.....*138
Drainage canal, Chicago..... 290
Drainage of Lake Copais.....*26
Draught, forced, effect of.... 50

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Dredge, dipper, powerful.....*116
Dredges for New York channels *25
Dry dock, new.....*377
Duell, Commissioner, resignation 179, 195

E

Earthquake waves, velocity.. 292
East River Bridge.....*246
East River Bridge, cables for. 130
Eclipse expedition...226, 244, 339
Educator, an..... 38
Efficiency in action..... 83
Egleston, Thomas, monument to 199
Electrical notes, 23, 38, 71, 87, 119, 151, 199, 215, 247, 294, 311, 343, 375, 391
Electricity, betting by..... 294
Electricity in 1900..... 4
Electricity, thefts of..... 199
Electro-capillary action..... 134
Electrograph, the.....*373
Elephant in plowing..... 367
Elevator disease, the..... 179
Elevators, electric service.... 119
Ellipsograph, an.....*106
Encke's comet..... 371
Engine, rotary, Porter.....*201
Engines, gas..... 387
Engineering in 1900..... 4
Engineering notes, 8, 23, 39, 55, 71, 86, 103, 151, 167, 183, 215, 231, 274, 327, 343, 358, 374, 390, 406
Engineering progress, American 178
Engineers, electrical, Africa.. *58
England, long-deferred decadence 98
Equipment, costly..... 370
Erie Canal muddle..... 242
Erie Canal, new..... 210
Eros, the celestial range finder 163
Eros, the light of..... 307
Excavations at Nippur.....*135
Exhibition, Charleston..... 122
Exhibition, Glasgow, 1901... 179
Expedition, Baldwin-Ziegler.. 275
Expedition, eclipse..... 226
Expedition, eclipse, Sumatra.. 244
Expedition to Labrador..... 134
Expeditions, polar, Baldwin.. 87
Expedition, south polar..... 134
Experiments of M. Curie.....*346
Explosion, boiler, a.....*228
Explosions, boiler..... *24
Explosive, maximite..... 322
Exports, our, of 1900..... 4
Exposition, automobile, Vienna 119
Exposition, Pan-American, 275, 298, 338, *361
Exposition, St. Louis, 1903.. 371
Expositions of 1900..... 4

F

Farming, irrigation..... *53
Faucet, automatic.....*404
Fender, car, Watson.....*372
Ferry bridge, colossal..... 86
Ferries, car, American..... *40
Fever, typhoid, from mangles 8
Fever, yellow..... 194
Fever, yellow, and mosquito.. 371
Field glass, military..... *10
Fifth-wheel, novel..... 282
Fire-alarm, pyrotechnic..... *6
Fire, a curious..... 86
Fire engines, steam, English. 390
Fire from waste paper..... 406
Fire pumps, electric..... 311
Fires in ships' holds..... 374
Firearm, German, new..... 151
Fish, self-burying..... 138
Fishing lines, silkworm guts.. 88
Fishing with a steam pump.. 150
Flint implements, discovery.. 151
Floor of East River Bridge... 374
Floor wax..... 392
Flowers, influence of darkness on..... 307
Fluoroscope, stereoscopic..... 71
Flying machine, Denny's..... 167
Flying machine, Hofman's...*281
Flying machine, new..... *72
Flying machine, Whitehead's.*357
Fog, London, cost of..... 86
Fomentations, press for..... *75
Foods of the Filipinos..... *35
Forest lands, preservation.... 243
Forestry, India and Canada.. 322
Forge, Boonton, old.....*165
Forum, discoveries in.....51, 119
Fountain, an ice.....*328
Fountains, illuminated.....*212
Frost valve, automatic.....*292
Fuel, alcohol, for motors..... 344
Fuel, liquid, for fire engines 343
Fulton, torpedo boat.....*388
Funeral trolley car..... 118
Furnace, refuse, new system 6
Furs, cold storage..... 243

G

Games, Chinese..... 99
Ganz system, the..... 194
Garden, botanical, new..... 3
Gas, acetylene, vs. petroleum. 250
Gas battery, new.....*310
Gas, cheap..... 294
Gas engines..... 387
Gas, new, from radium..... 243
Gas, thefts of..... 199
Gas, water, manufact..*39, *102
Gases produced by bacteria.. 262
Gasholder, cement concrete.. 343
Gasoline automobile.....*57, *148
Gasoline, runabout..... 57
Geological Society, American. 19
Georgia, wave line of..... 370
Gin, cotton, new.....*218
Glasgow Exhibition, 1901.... 179
Glass industry, new products. 242
Glass, plate, manufacture.... 311
Glassware, Germany, new.... 323
Glycerine, nitro, powders.... 274
Gold mining of Transvaal.... 230
Gold Room, Metropolitan Museum 23
Gongs, vehicle, abolishing.... 119
Goose, tailor's, novel.....*202
Grain in Alaska..... 99
Grain, a new..... 135
Grains, color of..... 314
Gramme, Zenobe T..... 115
Gramophone, simple.....*260
Granite, a large block of.... 231
Grapes, Hungarian..... 229
Grave, mound builder's..... 71
Gray, Elisha, death of..... *72
Grazing pen, moving.....*244
Great lakes, Canadian route.. 354
Great Salt Lake, recession.. 231
Gun, 7-inch vs. 6-inch..... 215
Gun, 16-inch, criticism..... 34
Gun, army, new..... 151
Gun, coast defense..... 306
Gun, disabled, Kearsarge's...*345
Gun erosion..... 114
Gun, field, quick-firing..... 261
Gun, quick-firing..... *20
Gun, Robinson Crusoe's..... 375
Gun-stock, adjustable.....*410
Gun, torpedo, Gathmann.....*313
Gun, weather, new.....*260
Guns, efficiency in action.... 83
Guns, Krupp, efficiency..... 354
Guns, old, destruction of..... 151
Gutta percha substitute..... 71
Gyroscopes, electrical.....*245

H

Hair, arsenic in the..... 244
Hammer, power, new.....*388
Harvesting, extraordinary.... 122
Hawaiian steamship..... 86
Haystacker, novel.....*250
Heat rays, transparency..... 54
Heavens in April..... 211
Heavens in February..... 67
Heavens in January..... 9
Heavens in July..... 403
Heavens in June..... 339
Heavens in March..... 131
Heavens in May..... 279
Helium, pure..... 87
Hichborn, Admiral, retired.. 130
Hill-climbing race, Paris.... 9
Hinge, a novel.....*106
Hoisting device..... *36
Holy Land, improvements in. 394
Homes, historic, photo record 387
House moving, 8-mile..... *56
Hydrants, valve for.....*122
Hydraulic plant in Java..... 330
Hydraulic plant, Swiss..... 86
Hydrogen from acetylene.... 371
Hygroscope, a simple..... *36
Hypo in photographic work. 211
Hypochlorites, apparatus for. 378

I

Ice conveyor, new.....*308
Ice, dielectric strength..... 294
Ice fountain.....*328
Ice in Brazil..... 183
Igniter, a new.....*292
Illinois, battleship..... 386
Illinois, trial of the..... 195
Independence, yacht.. *198, *389
Indigo, Bengal..... 291
Induction coil, new..... *7
Industrial crisis, Belgium... 103
Industry, a singular.....*202
Ingenuity, a triumph of.... 147
Ink well, breaking of an... *84
Insect, interesting..... 330
Insect parasite, an.....*394
Insects, Malayan..... 23
Institute, Smithsonian, report 174
Institutions for medical research 387
Insulator, new form of.....*106
Interrupter, Wehnelt..... 230
Invention, progress of..... 267
Inventions, Jefferson's..... 359
Inventions, novel..... *75
Inventions, prizes for..... 114
Inventions, recently patented 12, 28, 43, 59, 76, 107, 123, 139, 155, 187, 203, 235, 251, 267, 282, 299, 315, 331, 347, 363, 395, 411
Inventions wanted.....87, 358
Iron in New Zealand..... 327
Iron structures, protection of. 386
Iron rose.....*296
Irrigation farming..... *53
Irrigation, Hawaiian..... 20
Irrigation works, Nile.....*279
Island of Cerigo, discoveries. 231

J

Jerome Park Reservoir.....*342

K

Kammatograph 330
Kearsarge, gun, disabled....*345
Keller, Helen, speech of..... 58
Korea, launch of.....*228

L

Labrador, expedition to..... 134
Lace workers, strike among. 83
Lake Baikal, transportation. 290
Lake Copais, drainage..... *26
Lake, Great Salt, recession. 231
Lake Tanganyika..... 199
Lakes, Great, Canadian route 235
Lamp, arc, a new..... 38
Lamp, arc, Rasmus.....*250
Lamp, Cooper Hewitt..... 266
Lamp, incandescent, new.... 278
Lamps, incandescent and thunder 375
Lamps, lens for, tubular... *84
Lathe for granite columns.. *22
Launch of the Celtic.....*276
Launch of the Constitution..*312
Launch of the Fulton.....*388
Launch of the Korea.....*228
Launch of the Ohio.....*358
Launch of Shamrock II.....*293
Lead pencils in Germany.... 358
Lead, white, new process.... 151
Lens, tubular, for lamps.... *84
Lepers, treatment..... 243
Life saving apparatus..... 342
Life guard, Watson.....*372
Light, electric, for Wittkiel. 71
Light, incandescent, vs. eyes. 8
Light, Nernst..... 407
Light, therapeutic action.... 117
Light, wireless, Tesla's.... 67
Light, zodiacal..... 115
Lights, search, acetylene... 329
Lighting board, electric..... 186
Lighting trains from axle... *56
Lightning, damage by..... 343
Liquid, height in cask..... 102
Lizard, a two-tailed..... 23
Lizards, color change of.... 378
Locomotion, road..... 22
Locomotives, American, abroad 386
Locomotive boiler, Vanderbilt *100
Locomotive, express, German. *55
Locomotive, express, powerful*165
Locomotive of the future.258, 294
Locomotive, petroleum..... *36
Locomotive works, Baldwin.. 71
London bridge, renovation... 183
London and New York, growth 322
Long fog, cost of..... 86
Lord Armstrong..... 19
Lotus poison..... 130
Low, President.....*373
Lunchroom, a penny..... 51
Lubricator, Slater.....*234
Lysistrata, yacht.....*372

M

Macaroni, how made..... 115
Magnalium 151
Mail-box, novel.....*404
Mails, electric protection.... 227
Maine, raising, bids for..... 90
Malaria 199, *314
Malaria, transmission by mosquitoes 149
Mammon, age of..... 344
Man, truncated.....*105
Manhattan Railway, electric. 370
Mantis religiosa.....*105
Mantle, Welsbach, how made 153
Manuscripts at Mukden..... 8
Marble, testing *393
Mars, light flash from..... 179
Mars, signaling from..... 51
Mars, that message from.... 34
Mastodon, the Brooklyn.....*312
Maximite, tests of.....*325
Mercury bath, Hamy.....*388
Metal-beater, Thurston..... *27
Metal-cleaning compound..... 231
Metal, electrical resistance.. 106
Metal and woodworking.....*282
Metals, hardness of..... 410
Meteors seen in daylight.... 375
Meteorites, composition of... 278
Mica as an insulator..... 247
Microphone patent, Berliner. 162
Millinocket mill.....*230
Mineral resources, our..... 408
Mines, copper, American....*356
Mines, prehistoric..... 234
Mirograph, the..... *37
Mitrailleuse, automobile..... 343
Monkey skins, value of..... 151
Monorail system..... 258
Montcalm, cruiser..... *10
Moore, Edward B.....*275
Mortising machine, Smith...*346
Mosel-Saar Canal..... 88
Mosquito and yellow fever.. 371
Mosquitoes and malaria.148, *314
Motor vehicles, Holland..... 150
Motors, alcohol..... 362
Motors, electric, street car.. 409
Motors, gas..... 387
Motors, liquid-air, wanted... 119
Motors, solar.....*169
Motors, sun, for India..... 375
Motormen, school for..... 214
Movers, prime, cost..... 82
Mummy, a very ancient.... 99
Museum, Botanical Garden.. 227
Mutoscope, the.....*196

N

Naval bill..... 66
Naval construction, American 247
Navy, U. S., in 1900..... 5
Navy Yard work, high class 339
New York, vertical growth. *137
Niagara Falls, power plant *229
Nicaragua water supply..... 22
Nickel, specific heat..... 217
Nickel steel patent suit.... 281
Nicotine, effects of..... 387
Nile irrigation works.....*279
Nilgiri railway..... 390
Nippur, excavations at.....*135
Nitro cellulose powder..... 274
North River bridge bill..... 274
Novelties, patented.....*27, *122
Nut, relief..... *75

O

Observatory, Athens..... 42
Observatory, magnetic, new. 230
Ocher, French..... 215
Ohio, launch of the..... 359
Oil burner, wickless..... 218
Oil, pine needle.....*344
Oil well, Beaumont..... *74
Oil well in Texas..... 116
Omnibuses, electric, Berlin.. 214
Omnibuses, motor..... 310
Omnigraph, the.....*216
Orange peel, objects of..... *88
Oranges, blood, Germany.... 410
Orchestra-man, the.....*117
Ordnance, British.....*248
Ore unloader, automatic.....*153
Osmium lamp filaments..... 375
Ostrich feathers, industry....*164
Oxygen, commercial..... 167

P

Pail for fish bait.....*154
Paint, cold water..... 343
Pan-American Exposition, 275, 298, 338, *361
Papyri, Egyptian..... 119
Papyri, Egyptian, rare..... 99
Papyri from Oxyrhycus..... 231
Papyri, Ptolemaic..... 119
Park, cliff dwelling.....*297
Parthenogenesis, artificial, 179, 259
Patent commissioner, resignation 195
Patent decision, telephone.. 146
Patent decisions, three..... 179
Patent rights, new ruling.. 375
Patent suit, compromise of.. 281
Patent with a history..... 147
Patents, assist. commissioner.*275
Patents, commissioner, new.*227
Patents, commissioner, report 98
Patents, lucrative..... 88
Patents, Marconi..... 311
Paviosaurus, the..... 243
Pen, the Fowler.....*250
Pendulum beat, adjusting....*122
Petroleum for buoys.....*117
Petroleum well, Beaumont.. *74
Petroleum wells in Texas.... 116
Pharmacy in Germany..... 371
Philippines, life in the..... 346
Philippines, transport service *262
Phonograph record, permanent 147
Phonograph records, duplic.. 242
Phosphorus, preparation of.. 66
Phosphorus, production.....*180
Photo work, hypo in..... 211
Photograph, the largest..... 151
Photographs, X-ray..... 119
Photography in two colors.... 404
Photography, rapid 407
Photomicrography *329
Phototherapathy 117
Picture, moving, litigation.. 19
Pigeons, carrier, new use for. 55
Pile driver, a new.....*232
Pine needle industry.....*344
Pinto, Serpa, death of..... 115
Pipe galleries, rapid transit. 322
Pipe, steel, manufacture....*200
Pipe and stud wrench.....*186
Pipe wrench.....*138, *218
Pipes vs. cigars..... 387
Piping, wooden..... *6
Pitch Lake of Trinidad.....*166
Planets, communication with. 118
Plants of California.....*149
Plaster of Paris process, new 322
Plates, armor, corrosion of. 194
Plates, porous lead..... 215
Plays, Chinese, unscientific.. 99
Plow, double-share.....*263
Pod, corn.....*135
Pollok memorial prize..... 147
Pompeii, excavations at.... 119
Population of U. S. center.. 88
Port of call at Dover..... 183
Potter of Old Berry.....*135
Pound per H. P. economy... 82
Powder, smokeless.....114, 274
Power, hydraulic, of the Rhone 118
Power plant, Niagara Falls..*229
Power station, greatest.... 370
Press for fomentations..... *75
Prinzessin - Victoria - Luise, yacht 67, *86
Prize, the Bressa..... 154
Prize, Pollok memorial..... 147
Projectiles, manufacture in England 167
Propeller screw, new..... 55
Property, industrial, protection 50
Propulsion, turbine, progress. 82
Provisioning transatlantic liner *406
Pump, self-measuring.....*378
Pumps, valve motion for.....*154
Pyridine, effects of..... 387

Q

Quagga, the..... 281
Quarries, Carrara..... 55
Queen Victoria..... 66

R

Racine machine, De Dietrich*120
Radio conductor, Popoff.....*324
Radium, new gas from..... 243
Rail joints and strut poises.. 82
Rail, third, system..... 119
Rail, third system, Baltimore *168
Rails, British, export..... 7
Rails, creeping of..... 390
Railroad accident.....*184
Railroad, Tehuantepec..... 231
Railroads in the Caucasus... 38
Railroads of Roumania..... 346
Railway, electric, London.... 119
Railway, electric, underground 391
Railway, electric, Valtellina.*408
Railway, Great Eastern..... 292
Railway, Manhattan electric. 370
Railway, Nilgiri..... 390
Railway, Rome and Naples. 275
Railway, Tehuantepec..... 294
Railway tickets, automatic sale 358
Railway tie, metal.....*362
Railway, Trans-Siberian..... 84
Railway tunnel, street.....*185
Railway, underground, Boston *69
Railway viaduct, Des Moines.*340
Railways, electric, of Canada 292
Railways, electric, London.. 194
Railways, growth, England.. 167
Railways, steepest in the U. S. 70
Rain, bloody..... 291
Rain, red..... 263
Raisin culture, California... *3
Rangefinder, Eros, the..... 163
Rapid transit galleries..... 322
Rat, league against the.... 346
Rats, bacilli..... 90
Ray, X, photographs..... 119
Ray, X, tubes, new..... 323
Ray, X, work, present state.*245
Rays, Becquerel..... 213
Rays, heat, transparency.... 54
Rays, X, absorption laws.... 370
Rays, X, injury by..... 52
Reaper, sugar cane, wanted.*213
Record, Mariposa breaks the. 86
Refrigerator, doorlatch.....*138
Reid, James D., death of.... 294
Request, disingenuous..... 135
Reservoir, Jerome Park.....*342
Rhone, hydraulic power of.. 118
Rhone, water power of..... 375
Rice farming..... *53
Rifle, Lee-Enfield, efficacy.... 151
Rifle sighting device..... 36
Road locomotion 22
Rocking-chair and cradle....*410
Rock of Gibraltar, defense.. 358
Romans, ancient, clothing of. 387
Rose, iron.....*296
Rothwell, R. P., death of.... 259
Roumania, railroads of..... 346
Rowland, Henry A., death of. 259
Rubber cultivation, Mexico.. 307
Ruminant, peculiar..... 323
Runabout, gasoline.....*57, *148
Runner for vehicles..... *52

S

Saccharine, use forbidden.... 291
Sad-iron, novel.....*202
Safety collar for shafts.....*170
Salamander, cave, new..... 51
Salt deposit, remarkable.....*217
Samarium oxide..... 291
San Gimignano.....*148
Sandy Hook, results at..... 322
Santiago, battle of.....*121
Sarcophagus, marble, splendid 35
Sault Ste. Marie Canal..... 19
Saw setting machine..... *68
School for motormen.....*215
Science and curiosity..... 163
Science notes....8, 23, 35, 51, 71, 83, 99, 115, 151, 167, 179, 199, 231, 243, 291, 307, 323, 339, 359, 371, 387, 403
Scorpion, the.....*202
Scouts, 25 knot naval..... 371
Screw eye tool.....*292
Seat, vehicle, supplemental..*362
Seed distribution, government 151
Seeds, color of..... 314
Shaft, broken, repair of....*122
Shamrock II., launch of.... 293
Shamrock II., yacht.....*389
Shamrock and Constitution.. 306
Shamrock, factor of safety... 339
Shamrock under sail.....*328
Sheep fold, a moving.....*244
Sheep, foot and mouth disease 167
Sheep, mountain, new..... 115
Ship-subsidy bill..... 18
Ship, Viking, discovery of.... 8
Ships, iron, early..... 294
Shipping at Nagasaki..... 410
Shrimp, color change in..... 149
Siberia in glacial age..... 280
Sidewalk, moving, Paris.... 119
Signaling, submarine..... *73
Signals, submarine..... 34
Signals, system, automatic.. 294
Silk manufacture..... 118
Silk, treatment of..... 291
Silkworm gut fishing lines.... 88
Silkworms, colored light on.. 231
Simplon tunnel..... 178
Skeleton combat, a..... *38
Slag cement road, a..... 358
Smithsonian report..... 274
Soil, chemistry of..... 394
South Portland, steamer....*261
Speed of motor cars, recording 22
Spider, trapdoor.....*
Spinning machine, new..... 10
Sponge fishery, electric light in 199
Sports, Chinese..... 99
Spring for vehicles.....*362
Spy-glass, military..... *10
Stairs, fireproof..... 274
Standards for X-ray work.. 323
Star, new, in Perseus....146, 167
Stars, double, orbits of..... 51
Steam meter, a..... 39
Steam turbine.....18, 26
Steamer, ice-breaking..... 39
Steamers, high speed..... 114
Steamers, stern wheel.....*244
Steamship Hawaiian..... 86
Steamship, the modern..... 162
Steamship, raising a.....*261
Steamships, Clyde line..... 402
Steel cars.....*391
Steel works, new, projected.. 357
Step backward, a..... 226
St. Louis Exposition..... 371
Stonehenge, preservation of. 340
Stralau-Treptow tunnel.....*392
Street noises and rail joints 82
Stud and pipe wrench.....*186
Submarine, British navy.... 258
Subway of Berlin..... *84
Suez Canal..... 210
Suez Canal, traffic..... 183
Sugar bounties problem..... 35
Sugar cane reaper wanted..*213
Sugar, electrolytic..... 186
Sugar, Japanese..... 390
Sugar juice weighing.....*186
Sugar, Russian..... 116
Suicide statistics..... 199
Sun motors for India..... 375
Sunflower, the..... 153
Switch, ceiling.....*170
Switzerland, leveling of..... 231
Sylviculture 210
Synthol 323

T

Tailor's goose, novel.....*202
Tanganyika, Lake..... 199
Tarantula, the..... *202
Tasmania, native race of... 35
Tea, consumption, British.... 359
Technology, judgment in.... 107
Telegraph cable, longest.... 163
Telegraph, Cairo-Cape..... 294
Telegraph, facsimile.....*373
Telegraph, page printing, *181, *277
Telegraphy, aerial..... 194
Telegraphy, optical..... 294
Telegraphy, teaching.....*216
Telegraphy, wireless, 84, *72, 148, 215
Telegraphy, wireless, apparent *324
Telegraphy, wireless, experiment 87
Telegraphy, wireless duplex, 146, *152
Telegraphy, wireless, England 410
Telegraphy, wireless, on lighthouses 355
Telegraphy, wireless, Marconi....23, 138, 199, 247, 391
Telegraphy, wireless, in the navy 311
Telegraphy, wireless, steering by *101
Telegraphy, wireless, Tesla's 114
Telegraphy, wireless, on vessels 119
Telephone anto-commutator.. *85
Telephone business, status.. 340
Telephone company wins suit 8
Telephone exchanges of U. S. 362
Telephone journal, Budapest. 199
Telephone patent decision.... 146
Telephone, penny-in-the-slot.. 71
Telephone system, Chinese..*376
Telephones affected by rain.. 247
Telephones, public, New Haven 261
Telephones in South Africa.. *58
Telephony, long distance, Pupin's 50
Telephony, wireless..... 106
Tehuantepec railway.....231, 294
Theater of Augusta Taurivorum 119
Theater at Ephesus..... 119
Thorite, test of..... 259
Thorium compounds..... 290
Tie, railway, metal.....*362
Tiffany exhibit at Paris..... 38
Timber, conservation of..... 263
Tinfoil industry, growth of.. 354
Toads in rocks..... 100
Tobacco industry, the.....*309
Tobacco, new alkaloids..... 218
Tobacco, sweating..... 359
Tomatoes, canned, colored... 51
Topophone, the.....*197
Torch, marine..... 39
Torpedo gun.....*313
Torpedoes, steering.....*101
Towers of San Gimignano.. *148
Towing tank..... 66
Town, disappearing.....*296
Toy, mechanical..... *27
Traction, electric..... 247
Traction, electric, Europe... 306
Trade, advancing, our..... 210
Trade in machinery, German 370
Trade marks, registering.... 66
Trades union interference.... 34
Traffic, congested, of London 355
Train brake results..... 290
Train lighting, from axle... *56
Tr ir resistance..... 82
T underground, vibra- 98
Tramway, electric, London.. 344
Transit, rapid, Brooklyn..... 226
Trans-Pacific cable..... 323
Trans-Siberian Railway..... 84
Transparency of heat rays.. 54
Transport, army, abolition.. 306
Transport service, army....*262
Transport service, Philippines 182
Transportation in 1900..... 4
Transportation on Lake Baikal 290
Trees of California.....*149
Trees, distribution of..... 307
Tricycle, motor, De Dion... 9
Trinidad, Pitch Lake of....*166
Trolley car, fast..... 87
Trolley car, funeral..... 118
Trolley pole guard.....*308
Troops, loss in Philippines.. 355
Try-square, new.....*122
Tube expander, Burton..... *52
Tube, pneumatic, service.... 58
Tubes, mail, pneumatic..... 375
Tubes, X-ray, new..... 323
Tuberculosis, congress on.... 179
Tunica and toga, material of. 387
Tunis, tour of..... 150
Tupnel, East River..... 114
Tunnel to Isle of Wight.... 195
Tunnel, rapid transit, *37, *327, 370
Tunnel, Simplon..... 178
Tunnel, Stralau-Treptow.....*392
Tunnel, street railway.....*185
Tunneling craze..... 34
Turbine, Parsons.....*260
Turbine plant, Rodney Hunt.*230
Turbine propulsion..... 82
Turbine, steam.....18, 26
Turrets, superposed..... 98
Typesetting machine.....*150
Typewriter picture making.. *75

V

Vaccine virus..... *41
Vacuum pump, preserve jar. *75
Valve for hydrants.....*122
Valve, frost, automatic.....*292
Valve motion for pumps.....*154
Valve, reducing, automatic..*134
Vehicle, curious.....*410
Vehicle runner, new..... *52
Vessel, sailing, 20th century. 50
Vessels, lake, for Atlantic trade 226
Vessels, scout, fast..... 371
Vessels, submarine, British.. 258
Vesuvius, eruptive period... 203
Viaduct, railway, Des Moines.*340
Vibration, underground trains 98
Victoria 66
Village, Indian, remains of. 195
Virus, vaccine..... *41
Vise, bench and pipe.....*101
Voltaire, statue of..... 198
Von Zeppelin honored..... 106

W

Warships, fighting efficiency. 82
Water in ancient Rome..... 346
Water gas, manufacture, *39, *102
Water hyacinth nuisance.... 151
Water pipe, wooden..... *6
Water supply, New York....*342
Water system, Chicago.....*405
Water-way improvements... 27
Waterways of Canada..... 290
Waterwheels, ingenious.....*104
Wave line of the Georgia... 370
Waves, earthquakes, velocity 292
Wax, floor..... 392
Weather gun, new.....*260
Weevils, bean.....*298
Weighing liquids.....*186
Well, gushing, in Texas..... 52
Wells, oil, in Texas..... 116
Whales, running down.....*121
Wheat hospital.....*264
Wheel, fifth, novel.....*282
Whirlwinds in Germany.... 340
White House enlargement... 34
White, Sir William..... 114
Wind registering..... 198
Windmill electric plants.... 134
Windmills, novel.....*104
Wine production, French, 1900 277
Winklebury estate..... 387
Wood, fossilization..... 26
Wood and metal working....*282
Wood carving, imitation.... 387
Woodworkers competition.... 135
Workmen, favoritism to.... 27
Worm-gear, ball-bearing..... *27
Wrench, pipe.....*128, *218
Wrench, pipe and stud.....*186
Writing, erased, to recognize 38

Y

Yacht Constitution..... 295
Yacht, cup, framing for.... 216
Yacht designing..... 194
Yacht Independence.....*198
Yacht Lysistrata.....*372
Yacht Prinzessin - Victoria - Luise 67, *86
Yacht racing, development...*233
Yacht racing and the towing tank 66
Yacht, royal, new..... 114
Yachts, cup, of 1901.....*389
Year 1900, retrospect..... 4
Yellow fever..... 194

Z

Zea tunicata.....*135
Zinc in Poland..... 8

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